

# Nephrology in Latin America, with special emphasis on Brazil

**ROBERTO ZATZ, J.E. ROMÃO, JR., and I.L. NORONHA**

*Renal Division, Department of Clinical Medicine, Faculty of Medicine, University of São Paulo, São Paulo, Brazil*

## **Nephrology in Latin America, with special emphasis on Brazil.**

Latin America constitutes a complex universe that shows extreme variation regarding socioeconomic and human development. Brazil is the largest and most populous Latin American country, and combines characteristics encountered in developed countries with problems typically associated with the poorest regions of the world. These disparities condition the profile of renal disease in Brazil, with glomerulonephritis still the leading cause of ESRD. Little is known about the epidemiology of renal disease in the Brazilian (or Latin American) native population, which is numerous in some Central and South American countries, but constitute a very small minority in Brazil. However, interesting information has been obtained from the Yanomamis, a tribe living in Northern Brazil and Southern Venezuela. Hypertension is virtually absent among these people, who ingest very little sodium, lending strong support to the concept that sodium retention, a “civilization” factor, plays a role in the pathogenesis of arterial hypertension. Despite Brazil’s striking socioeconomic disparities, access to RRT is in principle accessible to all those in need of it. The dialysis units have been modernized in recent years, whereas the Government covers most expenses related to RRT. However, the prevalence of RRT in Brazil is currently ~320 per million population, less than one third as high as in the US, suggesting that ESRD may be underdiagnosed in the country. Much effort is still needed to limit the prevalence of renal disease and to improve the quality and the reach of RRT in Brazil and in Latin America.

Latin America, which comprises South American, Central American and Caribbean countries as well as Mexico, is a complex and very heterogeneous continent. While Mexico undergoes a process of progressive integration with its North American neighbors, the remaining Latin American countries exhibit extreme variation regarding socioeconomic and human development. This is clearly demonstrated by the distribution of the gross national product (GNP) for each country and, particularly, of the incomes per capita, which vary from a few hundred to over 10,000 United States dollars (US\$).

Given the high socioeconomic heterogeneity of the Latin American countries, it is hardly surprising that the

quantity and the quality of services such as the public health system show an equal degree of variation. In the case of nephrology, in the particular case of renal replacement therapy (RRT), this relationship becomes even more evident, as clear positive correlation can be observed between the prevalence of individuals on chronic dialysis and the income per capita in US dollars (Fig. 1).

With an area of 8.5 million km<sup>2</sup>, Brazil is the largest Latin American country and the fifth largest country in the world, occupying nearly half of the total area of the South American subcontinent. Most of the 170 million Brazilians (who represent exactly half the South American population) live in urban areas, especially in the Eastern and Southeastern coastal states, where the two largest Brazilian cities, São Paulo (also the largest South American city) and Rio de Janeiro, are located. The Southeast region, which includes the states of São Paulo and Rio de Janeiro, is the most prosperous in the country, and many of the large industrial and financial conglomerates are concentrated there.

The Brazilian population has a mixed ethnic composition. About 60% are Caucasians, descending from the Portuguese colonizers as well as from Europeans who immigrated mostly in the late XIXth and early XXth centuries. Blacks and mulattos of African descent constitute the second major ethnic group, followed by small Asian and Semitic minorities. Native Indians represent a very small minority of less than 0.5% of the total population. With the economic and social advances made in the country in the past few decades, the population has aged, the number of people with ages in excess of 65 years increasing by a factor of 5 since 1960 [1].

With a GDP at about US\$ 600 billion, Brazil ranks among the world’s largest ten economies, yet its social indices are still those of a typical Latin American nation. With a per capita income around US\$ 3500, close to the average Latin American value, Brazil combines characteristics encountered in affluent countries—a predominantly urban population, a large middle class, sophisticated shopping malls, sumptuous mansions and luxury cars in the cities, a well-developed car industry, an economy increasingly oriented toward services—with prob-

**Key words:** Latin America, Brazil, renal replacement therapy, Yanomami Indians, transplantation, schistosomiasis.

© 2003 by the International Society of Nephrology

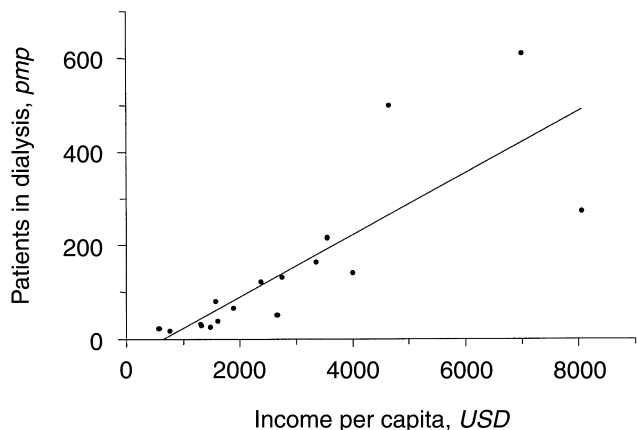


Fig. 1. Linear correlation between the proportion of patients in chronic dialysis (pmp) and income per capita in Latin America ( $r = 0.82$ ).

lems well known to the poorest regions of the planet: disseminated pockets of abject poverty, high infant mortality, endemic infectious/parasitic diseases, and poor educational indices.

The profile of renal disease in Brazil largely reflects its socioeconomic reality. Although complete nationwide registries are still lacking, some data indicate that glomerulonephritis remains a major cause of ESRD in Brazil. In a large epidemiological study (prevalence data) of 2905 patients on chronic dialysis in the city of São Paulo [2], chronic glomerulonephritis was found to be the leading cause (27.5% of cases) of ESRD, followed by hypertensive nephrosclerosis (16.6%). Diabetic nephropathy was considered the cause of ESRD in only 8% of cases. Similar data were published by the Brazilian Ministry of Health [3]. This pattern, which is similar to that of other Latin American countries [4], contrasts with that encountered in the US, where diabetes is the leading cause of ESRD, while glomerulonephritis accounts for only 16% of the cases [5]. When new ESRD cases are considered (incidence data) these disparities between the US and Latin America persist but tend to decrease [6]. Differences in age composition may explain part of these discrepancies, given the larger proportion of elderly people encountered in developed countries. However, hygiene conditions also may influence the ESRD profiles. For instance, a recent outbreak of post-infectious glomerulonephritis was caused by contaminated non-pasteurized cheese in a rural area of Southeastern Brazil, leading in at least some of the cases to the development of a progressive nephropathy [7]. The influence of poor socioeconomic conditions on the prevalence of glomerulopathies and the development of ESRD becomes even clearer in the case of *schistosomiasis*, a tropical parasitic disease that is endemic in the poorest rural areas of the Northeastern region, afflicting hundreds of thousands of people. The disease is caused by a nema-

tode, *Schistosoma mansoni*, and is transmitted through the intact skin by contact with the waters of contaminated ponds and lakes. Patients may develop hepatic fibrosis, often accompanied by severe portal hypertension. In 4.5% of these advanced cases, schistosomal nephropathy, which can manifest as membranoproliferative glomerulonephritis (GN), mesangial proliferative GN and focal and segmental glomerulosclerosis (FSGS), also develops and is often associated with the nephrotic syndrome [8].

Socioeconomic conditions also influence the profile of acute renal failure (ARF) in Brazil. Besides the classical causes of acute tubular necrosis that are observed also in more developed countries, such as hemorrhage and dehydration, ARF is often caused by poisonous animals such as snakes, spiders, bees and caterpillars [1]. As well, ARF can be caused by the direct action of infectious agents, such as in leptospirosis, tetanus and malaria. Leptospirosis is the most common of these infectious etiologies because of the frequent occurrence of urban floods, while malaria is usually found only in endemic areas near the Amazon region [1].

#### THE YANOMAMIS: LESSONS FROM A TINY MINORITY

Although Native Indians constitute a significant part of the population in some Central and South American countries, they are a very small minority in Brazil, amounting to a few hundred thousand altogether who are scattered mainly in the Northern part of the country. Unfortunately, there is little specific information about the prevalence and the nature of the renal diseases that may afflict these populations. However, one interesting piece of information was obtained from the Yanomamis, a tribe living in the Amazon rainforest of Northern Brazil and Southern Venezuela. Because of their eating habits, these people have an extremely low sodium intake. Hypertension is virtually absent among Yanomamis, as are other risk factors for coronary disease [9, 10]. Both sodium intake and the prevalence of hypertension increase with acculturation, strengthening the concept that sodium retention plays a role in the pathogenesis of arterial hypertension, and suggesting that a "civilization" factor may underlie human cardiovascular disease.

#### RENAL REPLACEMENT THERAPY IN LATIN AMERICA

##### Dialysis

The socioeconomic drawbacks common to the Latin American countries become more evident when life-supporting therapies for ESRD patients are considered. Overall, Latin America has about 300 patients per million population (pmp) in RRT, compared to ~1400 in

Japan, ~1100 in the US and ~650 in the European Union [6]. Since there is no reason to suppose that chronic renal disease is less prevalent in Latin America than in other parts of the world, these data indicate that ESRD has been either under-diagnosed or under-treated (or both) in these countries. However, the incidence of ESRD in Latin American countries has approached European levels in recent years, suggesting that this gap may become narrower in the long run.

The situation of RRT in Brazil suggests that at least in this case under-diagnosis may be a major factor lowering the prevalence of RRT. Despite the country's striking socioeconomic disparities, access to medical services in Brazil is universal, and even sophisticated medicine has been made accessible, at least in principle, to all those in need of it. Brazil is the only country in which anti-HIV medication is freely distributed to all seropositive individuals, and latest-generation diagnostic methods are available in public hospitals. Accordingly, nephrology is a well-established specialty in today's Brazil, having been established in the 1950s and gaining the status of a medical discipline in 1960. The Brazilian Society of Nephrology (SBN) has more than 2000 registered members, including pediatric nephrologists. There are more than 1300 medical doctors/per million population (pmp), corresponding to ~1 physician/700 inhabitants, and more than 10 nephrologists/pmp (corresponding to ~1 nephrologist/90,000 inhabitants), concentrated mainly in the more affluent South and Southeast regions.

Since 1974, the National Health Ministry has ensured that all ESRD patients have access to Government-sponsored RRT. Today, RRT centers exist in virtually the entire Brazilian territory, comprising 524 dialysis and 111 renal transplant units. The first hemodialysis session in Brazil was performed in 1949. In 1974, an official RRT program was implemented for patients with ESRD, while the CAPD program started in 1980. The opening up of the national economy, initiated in the 1990s, made it possible to modernize the dialysis units, improving the efficiency of procedures, and individualizing treatments. For instance, the use of cuprophane dialyzers has decreased as polysulphone and cellulose acetate dialyzers became more widely employed.

According to data provided by the Ministry of Health, almost 50,000 patients were on dialysis in Brazil by the end of 2001, corresponding to a prevalence of nearly 300 ppm, slightly above the Latin American average. However, again reflecting the Brazilian regional socioeconomic disparities, most of these patients were concentrated in the South and Southeast.

Despite some occasional fatal accidents, such as an outbreak of toxic hepatitis in a Northeastern unit six years ago [1], dialysis has been a safe procedure in Brazil, with an annual mortality rate of ~18%, similar to that verified in developed countries [3]. The current preva-

lence of hepatitis B virus infection among patients on chronic dialysis is slightly above 4%, while the prevalence of hepatitis virus C infection is about 19% [6]. With the widespread use of better prevention and isolation techniques, the incidence of both forms has decreased in recent years [1].

Less than 5% of the cases are covered by private health plans or by other kinds of health insurance. The Brazilian Ministry of Health pays approximately 47 US\$ per hemodialysis session including medical fees, while CAPD costs ~700 US\$/patient/month. Altogether, the expenses with dialysis amount to ~7700 US\$/patient/year. In addition, the Ministry of Health provides several pharmaceuticals used in the treatment of these patients, such as recombinant erythropoietin, calcitriol, antihypertensive drugs and hepatitis B vaccination. In 1996, new legislation on RRT was issued by the Brazilian Government, setting rigorous and detailed rules for the establishment of new dialysis centers as well as for the operation of functioning units. Besides defining several technical prerequisites, the new laws require the use of proportion dialysis machines, the treatment of water based on reverse osmosis and strict regulation of reuse.

Thus, once diagnosed, ESRD patients have ample access to RRT, especially to chronic dialysis. Unfortunately, as in other Latin American countries, ESRD is still under-diagnosed, and a proportion of these patients presumably die of terminal renal failure before receiving specific treatment.

### Transplantation

The impact of socioeconomic factors on renal transplantation in Latin America is also significant. Dialysis is by far the predominant RRT modality, with transplanted patients representing 22% of the total RRT population, as opposed to 50% in Denmark, 40% in France and 43% in Canada [6]. Accordingly, the number of renal transplants performed in 1999 was ~11 pmp, in contrast with 46 pmp in the USA and 41 pmp in Sweden. Use of living donors still predominates in Latin American countries (~43% in 1999, as opposed to 10% in Europe and 30% in the US).

In general, the situation in Brazil regarding renal transplantation is better than the Latin American average. Renal transplantation has been performed in Brazil since 1964, and the first regular kidney transplantation program started in 1965 at the University of São Paulo. There are currently 160 transplant centers in Brazil, 111 of which perform kidney transplantation. The total number of renal transplants has increased continuously since the 1970s, reaching nearly 3400/year (second only to the US numbers in absolute terms) by the end of 2001 [11]. Expressed as a proportion of the total population, the

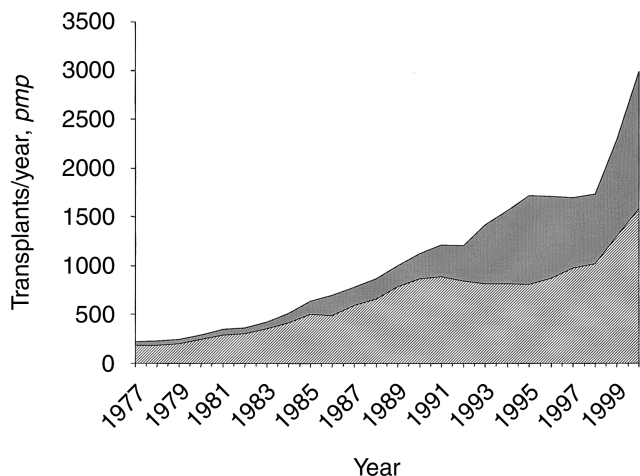


Fig. 2. Living (▨) and cadaver (■) renal transplants performed in Brazil since 1977.

number of renal transplants reaches ~22 ppm, twice the Latin American average.

Although transplants involving living donors were overwhelmingly predominant in the 1970s and 1980s, use of cadaver donors has steadily increased since the early 1990s, reaching almost half of the total in 2001 (Fig. 2). This reflects better organ procurement, increasing qualification of transplant teams, the use of better conservation techniques and, in the last five years, the organization of a single waiting list for organ sharing.

The Brazilian Government pays approximately 10,000 US\$ per kidney transplant procedure, including medical fees. The Health Ministry also finances the standard triple therapy (cyclosporine, azathioprine and steroids). More recently, several transplant centers introduced mycophenolate mofetil (MMF) and tacrolimus (FK-506), again with Government sponsorship, into immunosuppressive protocol.

## CONCLUSION

Both the profile of renal disease and the availability of RRT in Latin America are conditioned by socioeco-

nomie shortcomings, rather than by racial composition. As the largest and most populous Latin American nation, Brazil is representative of the overall Latin American dichotomy: on one hand, poverty and insufficient primary medical attention lead to the development of specific renal diseases, while limiting the diagnosis of ESRD. On the other, the degree of socioeconomic development already attained allows sophisticated management of a large fraction of ESRD patients, approaching in some respects the standards of quality observed in more developed regions of the world. Much effort is still needed to limit the prevalence of renal disease and to improve the quality and the reach of RRT in Latin America.

Reprint requests to Dr. Roberto Zatz, Av. Dr. Arnaldo, 455 3-s/3342, CEP: 01246-903, São Paulo, SP Brazil.

## REFERENCES

1. NORONHA IL, SCHOR N, COELHO SN, et al: Nephrology, dialysis and transplantation in Brazil. *Nephrol Dial Transplant* 12:2234-2243, 1997
2. SESSO R, ANÇÃO MS, MADEIRA SA: Epidemiologic aspects of the dialysis treatment in Grande São Paulo. *Rev Assoc Med Bras* 40:10-14, 1994
3. BRAZILIAN MINISTRY OF HEALTH: *Medical Assistance to the Chronic Renal Failure Patient*. Brasília, Brazil, 1997
4. MAZZUCHI N, SCHWEDT E, FERNANDEZ JM, et al: Latin American Registry of dialysis and renal transplantation: 1993 annual dialysis data report. *Nephrol Dial Transplant* 12:2521-2527, 1997
5. US RENAL DATA SYSTEM: *Annual Data Report*. Bethesda, U.S. Department of Health and Human Services, National Institutes of Diabetes and Digestive and Kidney Disease, 1999
6. LATIN AMERICAN SOCIETY OF NEPHROLOGY: *2001 Annual Report*. <http://www.registroslanh.org.uy/informe>
7. PINTO SW, SESSO R, VASCONCELOS E, et al: Follow-up of patients with epidemic poststreptococcal glomerulonephritis. *Am J Kidney Dis* 38:249-255, 2001
8. ANDRADE ZA, ROCHA H: Schistosomal glomerulopathy. *Kidney Int* 16:23-29, 1979
9. OLIVER WJ, COHEN EL, NEEL JV: Blood pressure, sodium intake, and sodium related hormones in the Yanomamo Indians, a "no-salt" culture. *Circulation* 52:146-151, 1975
10. MANCELHA-CARVALHO JJ, CARVALHO JV, LIMA JA, SOUSA E SILVA NA: *Arq Bras Cardiol* 59:275-283, 1992
11. *Quarterly Report - July-September: 2001*. Brazilian Transplantation Registry, [http://www.abto.com.br/rbt/frm\\_rbt.htm](http://www.abto.com.br/rbt/frm_rbt.htm)