Prevalence and factors associated with chronic kidney disease among hospitalized patients in a university hospital in the city of São Paulo, SP, Brazil

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ABSTRACT

Introduction: Chronic kidney disease (CKD) is a major public health problem worldwide. Nonetheless, little is known about its features in Brazil. **Objective:** To identify prevalence and factors associated with CKD among hospitalized patients in a university hospital. **Methods:** We randomly selected 826 medical records of patients admitted in 2009 in the medical inpatient unit. We defined CKD as the presence of medical diagnosis or personal history. We collected a number of clinical and demographic information and these variables were compared between patients with and without CKD. **Results:** CKD prevalence was 12.7%. Patients with CKD differed from patients without ($p < 0.05$) regarding to: living with a partner (59.8% *vs.* 47.3%), older age (65.8 ± 15.6 *vs.* 55.3 ± 18.9 years-old), more comorbidities as hypertension (75.2% *vs.* 46.3%), diabetes (49.5% *vs.* 22.4%), dyslipidemia (23.8% *vs.* 14.9%), acute myocardial infarction (14.3% *vs.* 6.0%) and congestive heart failure (18.1% *vs.* 4.3%); length of hospitalization (11 (8-18) *vs.* 9 (6-12) days); and death occurrence (12.4% *vs.* 1.4%). The logistic regression analysis showed an independent association (OR, odds ratio, CI, confidence interval 95%) of CKD with age (OR 1.019, CI 1.003 to 1.036), hypertension (OR 2.032, CI 1.128 to 3.660), diabetes (OR 2.097, CI 1.232 to 3.570) and congestive heart failure (OR 2.665, CI 1.173 to 6.056). **Conclusion:** CKD prevalence among patients in a medical inpatient unit was high and CKD patients were more complex, as they were older and had a great number of co-morbidities, reflecting a greater risk of death during hospitalization.

Keywords: hypertension; kidney failure, chronic; risk factors.

INTRODUCTION

Chronic kidney disease (CKD) has taken on the status of public health concern in recent years, due to its increased prevalence among the world's population and its impact on morbidity and mortality in affected patients. Mainly a result of the growing epidemic of cardiovascular risk factors, chronic kidney disease causes frequent hospitalizations and high socioeconomic cost.[1-4]

In 2011, there were 91,314 individuals on dialysis in Brazil, corresponding to a prevalence of 475 pmp.[5] We have less patients on renal replacement therapy when compared to developed countries.[6-8] One explanation for this discrepancy may be the low participation of dialysis centers in the census; however, the most alarming hypothesis rests on the poor access to healthcare services. It is believed that 50-70% of Brazilians who have chronic kidney disease die without being submitted to any kind of treatment.[2,9]

Data on morbidity and mortality of chronic renal failure patients in Brazil is still very restricted to the dialysis population. In fact, kidney failure treated with dialysis or transplantation is the outcome of chronic kidney disease that most stands out. However, cardiovascular diseases are often associated with chronic kidney disease, which is of great importance when we consider that chronic kidney patients are more likely to die of

cardiovascular disease than evolving into kidney failure.[10] Thus, little is known on the prevalence, morbidity and mortality of early-stage chronic kidney disease in Brazil.

Faced with this problem, this study aims at identifying the prevalence and factors associated with chronic kidney disease in individuals who have undergone hospitalization in a university hospital.

Method

This was an exploratory, cross-sectional and quantitative study, carried out between December of 2010 and June of 2013.

The sample consisted of adult patients (age ≥ 18 years) admitted to the internal medicine ward of a university hospital in São Paulo, Brazil, during the year of 2009.

We collected data retrospectively from the medical records of each patient and by means of an instrument designed for this purpose. We also collected sociodemographic and anthropometric information, health history, lifestyle, medical diagnostics and hospitalization outcomes.

Pregnant women, patients staying less than 24 hours in the clinical wards, those without serum creatinine measured in at least two occasions during the hospital stay and patients who progressed during hospitalization to acute kidney injury according to AKIN[11] criteria (increased serum creatinine equal to or higher than 0.3 mg/dL in the patients without clinical diagnosis of CKD) or those on medical diagnosis of acute renal failure were taken off the study.

CKD was defined as the presence of a medical diagnosis of CKD reported on at least one occasion in the medical chart.

Statistical analysis

For sample size calculation we used the CKD prevalence estimation of 13%, as described by Coresh *et al.*[12] as a representative sample of the US population, with a 5% variation, 5% type I error and 80% test power. Under these parameters, the size of the representative sample of the population of patients admitted to the internal medicine ward would be 386 individuals. The CKD prevalence value suggested for the sample calculation is higher than those described in studies carried out with Brazilian populations.[13,14] However; we believe that our sample had a higher frequency of CKD because it is an older population and with comorbidities - although the CKD criterion was based solely on the presence of medical diagnosis in medical records. The records were randomly chosen by a randomization tool available in Microsoft Excel.

We assessed the association between categorical variables and the group with CKD using the chi-square test, likelihood ratio test or Fisher's exact test. For quantitative variables, we used the *Student t*-test to compare the means of normally distributed variables or the Mann-Whitney test to compare the interquartile distributions. The variables that were statistically significant in the univariate analysis and reported in the literature as a potential risk factor for chronic kidney disease were used to adjust the multiple logistic regression model. *P* values < 0.05 were considered statistically significant.

Results

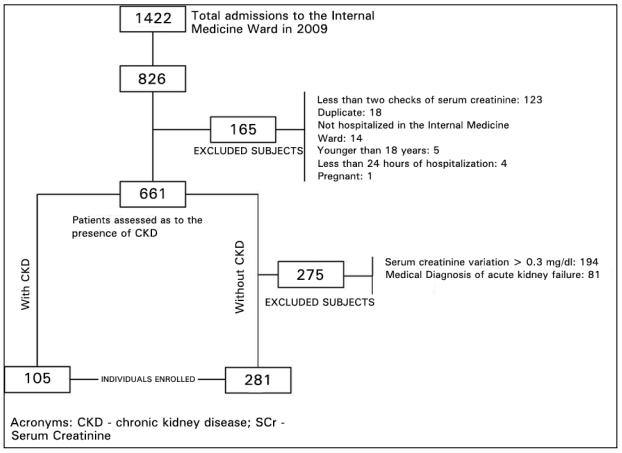
According to the hospital's admissions record, 1,422 patients were admitted to the internal medicine ward during the study period.

After adopting the exclusion criteria, 105 subjects with CKD were identified, accounting for a prevalence of 12.7% within the 826 records analyzed (Figure 1). Among CKD patients, 27 (25.7%) had stage 5 CKD under dialysis. Finally, 386 patients were included in the final sample, 105 with CKD and 281 without CKD.

According to the biosocial characteristics depicted on Table 1, patients with CKD were distinguished from those without CKD for being older and having a steady partner ($p < 0.05$). Now, patients without CKD stood out because they had a higher prevalence of smoking ($p < 0.05$).

Regarding health history, a vast majority (89,5%) and just over half (55.2%) of the patients with and without CKD, respectively, had at least one comorbidity. Of the 105 patients identified as chronic renal failure patients, 53.3% already had

Figure 1. Sample make up flowchart.



a history of the disease recorded in their medical charts. There was a significant difference ($p < 0.05$) between groups with and without CKD regarding the presence of arterial hypertension (75.2% *vs.* 46.3%), diabetes (49.5% *vs.* 22.4%) and congestive heart failure (18.1% *vs.* 4.3%) - Figure 2.

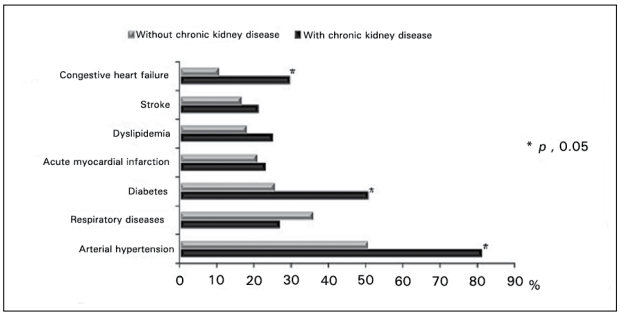
Two thirds of the patients were being followed up in a healthcare service, a more frequent occurrence among those with CKD (87.8% *vs.* 58.0%, $p < 0.001$). It is noteworthy that more than 10% of patients with CKD were not under any follow-up care, although 36.4% of them had personal history of the disease.

CKD patients had longer hospital stays ($p < 0.05$) compared with those without the disease, as well as higher mortality rates (Table 2). Of patients diagnosed with stage 5 CKD, 65.4% started renal replacement therapy during hospitalization, and 58.8% had no previous history of CKD. Except for one patient who died, these patients were referred to dialysis clinics after hospital discharge.

Table 1 Biosocial characteristics of the patients admitted to the internal medicine ward according to having chronic renal disease or not. São Paulo, 2014

Variables	With chronic kidney disease (N = 105)		Without chronic kidney disease (N = 281)		Total (N = 386)		*p*-value
	N	%	N	%	N	%	
Gender							0.655
Males	55	52.4	140	49.8	195	50.5	
Females	50	47.6	141	50.2	191	49.5	
Race (n = 385)							0.385
White	64	61.0	184	65.7	248	64.4	
Not white	41	39.0	96	34.3	137	35.6	
Marital status (n = 377)							0.031
Without a spouse	41	40.2	145	52.7	186	49.3	
With a spouse	61	59.8	130	47.3	191	50.7	
Occupation (n = 374)							0.945
Active worker	38	38.0	109	39.8	147	39.3	
Retired	31	31.0	79	28.8	110	29.4	
Housewife	26	26.0	69	25.2	95	25.4	
Unemployed or student	5	5.0	17	6.2	22	5.9	
Smoking (n = 368)							< 0.001
Yes	11	11.1	80	29.7	91	24.7	
Quit	43	43.4	84	31.2	127	34.5	
No	45	45.5	105	39.0	150	40.8	
Age (years)							< 0.001
Mean ± SD	65.8 ± 15.6		55.3 ± 18.9		58.2 ± 18.6		
Body mass index (kg/m^2) (n = 162)							0.684
Median (1$^{st.}$ 3rd quartiles)	26.0 (22.3-28.7)		25.0 (21.7-28.3)		25.4 (21.7-28.4)		

Figure 2. Main clinical diagnosis of the patients admitted to an internal medicine Ward with and without chronic kidney disease. São Paulo, 2013.



The multiple logistic regression model (Table 3) included the following variables: marital status, smoking, age and personal history significantly associated with CKD in the univariate analysis. We noticed that for each additional year in age, CKD likelihood was 1.9% higher. Hypertension or diabetes increased the likelihood of having CKD in two fold and heart failure in 2.6 fold.

Discussion

The main finding of this study revealed that CKD in patients a dmitted to an internal medicine ward was associated with the main cardiovascular risk factors amenable to intervention: hypertension and diabetes. Such risk factors, besides age, are recognized worldwide for their great impact on patient morbidity and mortality.

CKD Individuals were older than those without the disease. This finding is consistent with several studies that have shown its association with age. The prevalence of CKD among individuals older than 65 years ranged from 5.8 to 51% in different international studies. Although the values are discrepant, they were all much larger than those of younger age groups in their studies indicating an almost exponential increase in the prevalence of chronic kidney disease with age.[15,16]

Table 2 Hospitalization outcomes of the patients admitted to an internal medicine ward, with and without chronic kidney disease. São Paulo, 2014

Hospitalization outcomes	With chronic kidney disease (N = 105)		Without chronic kidney disease (N = 281)		Total (N = 386)		*p*-value
	N	%	N	%	N	%	
Admitted to an ICU							0.118
Yes	16	15.2	27	9.6	43	11.1	
No	89	84.8	254	90.4	343	88.9	
Outcome							< 0.001
Discharge	90	85.7	262	93.2	352	91.2	
Death	13	12.4	4	1.4	17	4.4	
Transfer to another hospital	1	1.0	13	4.6	14	3.6	
Loss of follow up	1	1.0	2	0.7	3	0.8	
Post-discharge referral (except for renal replacement therapy, n = 343)							0.104
UBS	12	18.2	55	19.9	67	19.5	
Wards	12	18.2	22	7.9	34	9.9	
Tertiary care hospital	5	7.6	24	8.7	29	8.5	
Homecare	5	7.6	13	4.7	18	5.2	
Others	1	1.5	17	6.1	18	5.2	
No data	31	47.0	146	52.7	177	51.6	
Hospitalization duration (days)							< 0.001
Median (1st. - 3rd. quartiles)	11.0 (8.0-18.0)		9.0 (6.0-12.0)		9.0 7.0-13.0)		

Table 3 Chronic kidney disease predictors in patients admitted to an internal medicine ward according to a multivariate analysis. São Paulo, 2014

Variables	Odds ratio	Confidence interval I		*p*-value
		Lower	Upper	
Age (per additional year)	1.019	1.003	1.036	0.024
Arterial hypertension	2.032	1.128	3.660	0.018
Diabetes	2.097	1.232	3.570	0.006
Congestive heart failure	2.665	1.173	6.056	0.019

While the prevalence of hypertension in Brazilian studies was around 30%[17,18] in the general population, patients with CKD identified in this sample were different due to a higher prevalence of hypertension (81.0% *vs*. 50.5%) compared to those without CKD.

In fact, high blood pressure has been considered a ubiquitous disease in CKD; because, besides being one of the most important causes for the disease onset and development, high blood pressure is a result of CKD.[19] North American data from the Kidney Early Evaluation Program (KEEP), reported an increased prevalence of hypertension in a population at risk of CKD, according to glomerular filtration rate estimates (eGFR) in the period from 1994 to 2004: 56.6% for eGFR > 100 ml/min/1.73 m^2; 72.4% eGFR to 60-70 ml/min/1.73 m^2; and 95.6% for eGFR < 30 mL/min/1.73 m^2. The same trend was observed in a population sample from the National-Health and Nutrition Survey Examination (NHANES), following the same criteria and study period, although the frequency of hypertension has been lower.[20]

The prevalence of diabetes mellitus found in this study (32.1%) was higher than the prevalence reported by telephone survey for the adult population (5.2%) and the elderly (18.8% for ages between 65 and 74 years, and 17.6% for age less than 75 years) in Brazil.[21] the presence of diabetes mellitus was significantly higher among patients with CKD: 50.5% *vs*. 25.3%. In fact, the prevalence of diabetes among chronic kidney patients has been higher than that of individuals without CKD.[22,23]

The prevalence of diabetes in chronic renal failure patients in the present study was higher than that reported in several studies with this population[22-24] or even than the prevalence reported in a sample of individuals on renal replacement therapy in Brazil (30.6%),[25] suggesting higher hospital morbidity among these individuals. There is also the possibility that diabetes mellitus may become more relevant in the etiology and comorbidity of CKD in Brazil in the near future.[26]

CKD was also significantly associated with heart failure in our country, almost three times more common in affected individuals. Although the decrease in cardiac output brought about by the disease itself or its treatment can participate in the genesis of progressive kidney damage,[27] it should be noted that the main causes of congestive heart failure are hypertension and ischemia, both closely associated with arterial hypertension.[28]

Another finding of epidemiological relevance, although secondary to the process of sample selection, was the prevalence of CKD. Considering the exclusion steps associated with the individuals, to which the criteria were applied to the total population, we found a chronic kidney disease prevalence of 12.7%.

The value found is right inside the reported prevalence in international studies (0.6 to 43.3%),[29,30] and close those found among in the elderly (12.9%; 95% CI, 4.3 to 20.3)[13] and in a small city (12.8% of moderate to severe chronic renal failure patients)[31] in Brazil. It is, nonetheless, higher than that found in a Brazilian population screening (7.3%).[32] Although the CKD prevalence comparison is compromised by the specificity of the present study sample and disease definition criteria, it stands out that CKD is very frequent in hospitalized patients in an internal medicine ward. Brazilian data on hospital morbidity, besides corresponding to the main diagnosis for hospitalization, refers to the chapters and lists of morbidity in the International

Classification of Diseases (ICD-10), in which the different etiologies of CKD are diluted. If we consider "renal failure" morbidity (not specified as acute or chronic), it appears that this represented only 0.7% of the main admission diagnoses in 2009;[33] while 4.1% of admitted patients to the internal medicine ward of the present study had end-stage renal disease. Thus, it is clear the importance of CKD in hospital morbidity in a general hospital unit in Brazil.

Nearly half of individuals with CKD had no personal history of the disease in their medical charts, although most reported having been followed in a healthcare facility. The frequency of patients who started renal replacement therapy and who had no personal history of CKD suggests that a significant part of the Brazilian population with chronic renal failure is only later referred to a nephrology service,[34] and this may lead to the worsening in their outcomes.[35,36]

As for the associations observed in relation to hospitalization outcomes, longer hospital stays of patients with CKD was congruent with the highest morbidity found in this group. The high death rates among CKD patients compared to those without CKD in our country has shown the important relationship between CKD and mortality, reported by numerous international studies.[37-40]

Conclusion

Despite the limitations of this study - associated with its retrospective design, the frequent lack of data in medical records and CKD diagnosis be credited to non-confirmed information in the medical records, chronic kidney disease was associated to the main modifiable cardiovascular risk factors. Facing this, we reiterate the need to improve primary care follow-up of patients with hypertension and diabetes. While hospitalization continues to be the "gateway" in the Brazilian healthcare system for a significant portion of the population, the recognition of factors associated with CKD can be crucial to the proper continuity of treatment for chronic renal failure patients in the long term.

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