Management of Hypertension in Patients With CKD: Differences Between Primary and Tertiary Care Settings

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● **Background:** Although most patients with moderate chronic kidney disease (CKD) are managed exclusively in primary care (PC), no data on blood pressure (BP) control in this setting are available. We compared hypertension management in patients with CKD followed up in PC and nephrology tertiary care (TC). **Methods:** We studied hypertensive patients with estimated glomerular filtration rates (eGFRs) of 15 to 60 mL/min/1.73 m² (0.25 to 1.00 mL/s) exclusively followed up for at least 1 year in PC (n = 259) or TC (n = 186). **Results:** PC compared with TC patients were characterized by older age (73 ± 10 versus 65 ± 14 years; P < 0.0001), greater prevalences of previous cardiovascular events (59% versus 32%; P < 0.0001) and diabetes (36% versus 23%; P = 0.005), and slightly greater eGFRs (37 ± 10 versus 34 ± 11 mL/min/1.73 m²; P = 0.005). They showed higher BP levels (143 ± 15/82 ± 7 versus 136 ± 18/78 ± 11 mm Hg; P < 0.0001), with a lower prevalence of BP target (5.8% [95% confidence interval (CI), 2.9 to 8.6] versus 21.5% [95% CI, 15.6 to 27.4]; P < 0.0001). The risk for not achieving BP target in PC was 2.6 times greater, independently from age, sex, diabetes, and eGFR. Fewer antihypertensive drugs were prescribed in PC (1.9 ± 1.1 versus 2.5 ± 1.1; P < 0.0001). In both groups, inhibitors of the renin-angiotensin system were the most frequently prescribed drugs (>84%), followed by diuretics (50%). However, family physicians almost exclusively prescribed hydrochlorothiazide, whereas nephrologists preferentially prescribed furosemide, administered at a higher dose than in PC (47 ± 41 versus 28 ± 21 mg/d; P = 0.004). **Conclusion:** Control of CKD-related hypertension is significantly worse in PC despite a greater cardiovascular risk. Barriers to optimal BP control likely are represented by a low number of drugs and inadequate diuretic therapy. Am J Kidney Dis 46:18-25.

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INDEX WORDS: Chronic kidney disease (CKD); hypertension; diuretics; primary care; tertiary care; nephrology clinic.

IN PATIENTS WITH chronic kidney disease (CKD), hypertension is highly prevalent and is a major determinant of progression of renal disease.1-3 More important, high blood pressure (BP) is an undisputed risk factor for cardiovascular (CV) disease.1,4 This point is critical considering that for these patients, CV risk is dramatically high and greater than the risk for reaching end-stage renal disease.5,6 Conversely, intensive antihypertensive treatment prevents the development of CV events during the predialytic phase7,8 and ameliorates survival in the subsequent di-lytic stage.9 Therefore, strict control of BP to less than 130/80 mm Hg is now considered a main goal for the care of patients with CKD.1,4

Most patients with moderate CKD are managed exclusively by primary care (PC) physicians.10 In the future, this approach will represent a necessity for nephrologists and an opportunity for patients if one considers that the exponential increase in prevalence of CKD will make nephrology manpower inadequate.11 However, recent studies have emphasized that the lack of nephrology referral in patients with CKD is coupled with a 2-fold greater risk for death.12,13 Therefore, comparative analysis of BP control in PC and tertiary care (TC) becomes mandatory.14-16 Knowledge of clinical features of patients with CKD and evaluation of therapeutic intervention in PC and TC represent the first step to correctly plan a shared program for the treatment of patients with CKD. To date, no study has provided a systematic comparison on the control of hypertension between family physicians and nephrologists.

The present study is designed to evaluate the adequacy of BP control in hypertensive patients with mild to severe CKD exclusively followed
up by PC physicians. Patients from the same
urban area regularly seen by nephrologists were
used as the control group.

METHODS

The study was performed in hypertensive patients with
CKD followed up in the outpatient clinic of the Department
of Nephrology, Second University of Naples (Coordinator
Centre), Italy, and in family physicians’ offices of the
National Healthcare System operating in the same metropoli-
tan area. Both family physicians and nephrologists studied
patients seen during the same 6-month period (from July 1
to December 31, 2003). Patients exclusively followed up by
family physicians were defined as PC patients; these patients
were seen regularly in offices outside the hospital. Con-
versely, patients followed up in the outpatient clinic of the
hospital Nephrology Department are defined as TC patients.

PC Patients

We preliminarily contacted family physicians operating in
the same urban area as our Department of Nephrology to
illustrate the protocol. Thirty-nine of 42 physicians agreed to
participate in the study. Before collecting data, we formu-
lated a questionnaire to assess whether PC physicians were
aware of the BP target suggested by international guidelines
for patients with CKD.

They were asked to identify, within the study period,
consecutive patients with 2 determinations of serum creati-
nine levels of 1.2 mg/dL or greater (≥106 μmol/L) for
women and 1.4 mg/dL or greater (≥124 μmol/L) for men,
separated by at least 3 months. Because the electronic
patient’s chart for PC physicians did not include an evalua-
tion of creatinine clearance, we implemented creatinine
clearance calculation based on the Cockcroft-Gault equation
(estimated glomerular filtration rate [eGFR]). Therefore, PC
physicians were able to select patients with an eGFR be-
tween 15 and 60 mL/min/1.73 m² (0.25 and 1.00 mL/s)
assessed on 2 occasions 3 months apart, length of follow-up
of at least 1 year, presence of hypertension (treatment with
antihypertensive medication or BP ≥ 130/80 mm Hg in the
absence of therapy), and no follow-up in a nephrology
clinic. To avoid changes in BP caused by variations in renal
function, we excluded patients with changes in eGFR greater
than 30% between 2 determinations with an interval of 3
months or longer. Patients with advanced CKD (eGFR < 15
mL/min/1.73 m²) also were excluded because they usually
are followed up by TC.

The patients selected, after giving their written informed
consent to the study, constituted the PC group. In all these
patients, PC physicians prescribed urinary and blood labora-
tory tests, which had to be performed within 1 week, to
obtain a recent assessment of renal disease. The list of
biochemical tests was provided preliminarily by the Coordin-
ator Centre. When patients returned with laboratory results,
they underwent a medical visit (cross-sectional study visit)
in which body weight, height, and BP were measured and
recorded. During this visit, the family doctor collected
patient data according to a structured anonymous form
previously provided by the Coordinating Centre.

TC Patients

The group of patients followed up in a TC setting (TC
group) was selected from consecutive patients seen in the
same period as the PC group at the outpatient renal clinic at
the Second University of Naples. The same inclusion and
exclusion criteria described for the PC group were applied,
and data were analyzed according to the same form used by
PC. Patients in this group were followed up by 3 different
nephrologists.

Measurements and Calculations

The diagnosis of primary renal disease was made by
family physicians on a clinical basis and successively veri-
fied by nephrologists before analysis of data. Correct diag-
noses were obtained by PC in 97.7% of cases.

Renal function was estimated by using the Cockcroft-
Gault equation and 24-hour measured creatinine clearance.
The 24-hour urine collection was considered inaccurate and
discarded if creatinine excretion was outside the 60% to
140% range of the value calculated according to Dwyer and
Keller.17 Creatinine was measured in plasma and urine in all
participants by means of the modified kinetic Jaffé reaction.
Coefficients of variation for creatinine determination in our
laboratory were 2.9% at 1.5 mg/dL (133 μmol/L), 2.1% at
3.0 mg/dL (265 μmol/L), and 1.8% at 4.5 mg/dL (398
μmol/L). In all participants, BP was measured by doctors
(family physicians and nephrologists) by using a mercury
sphygmomanometer in the morning with patients in a sitting
position after 10 minutes of rest. The first and fifth Korotkoff
sounds were used to define systolic and diastolic BP values,
respectively. The mean of 3 consecutive readings obtained 2
minutes apart was used for statistical analysis. We consid-
ered BP at target if less than 130/80 mm Hg.1,16

Statistics

Data were analyzed using SAS, version 8.1 (SAS Inc,
Cary, NC). Values are reported as mean ± SD for variables
with normal distribution and median and range for variables
with non-Gaussian distribution. The prevalence of BP target
is reported as percentage and 95% confidence intervals
(CIs). Unpaired Student t-test or Mann-Whitney test was
used for intergroup comparisons. Chi-square test was used
to compare categorical variables. Multivariable logistic regres-
sion analysis was performed to investigate relationships
between groups and achievement of BP target. The modeling
strategy was to first enter care groups, age, sex, diabetes
status, eGFR, and duration of hypertension. Additional ex-
planatory covariates then were tested individually when
added in a stepwise fashion to the basic model. Variables
were retained in the model if the likelihood ratio test was
significant at P less than 0.05. Goodness of fit was assessed
by using the Hosmer-Lemeshow test based on grouping
subjects into deciles of risk.18 Two different analyses were
performed; 1 analysis used the BP target for patients with
CKD (<130/80 mm Hg) and the second used the target for
patients with essential hypertension (<140/90 mm Hg).
Two-tailed P less than 0.05 is considered significant.
RESULTS

The 39 participating PC physicians were in charge of a total population of 55,254 individuals, with 22,108 subjects (46.6%) seen in the 2-month study period. Serum creatinine levels (2 measurements separated by at least 3 months) were available for 18,891 subjects; of this group, 296 patients (1.6%) showed an eGFR of 60 mL/min/1.73 m² or less (\(\leq 1.00\) mL/s). All eligible patients gave their informed consent to participate to the study. We excluded 5 patients with changes in eGFR greater than 30%, 9 patients who were normotensive, 13 patients who had consulted nephrologists, and 10 patients because of both eGFR of 15 mL/min/1.73 m² or less (\(\leq 0.25\) mL/s) and regular follow-up in nephrology. Therefore, there were 259 PC patients.

In TC, 327 patients were visited consecutively during the study period. Of these, 283 patients had an eGFR of 60 mL/min/1.73 m² or less (\(\leq 1.00\) mL/s). We excluded 25 patients with changes in eGFR greater than 30%, 69 patients with an eGFR of 15 mL/min/1.73 m² or less (\(\leq 0.25\) mL/s), and 3 normotensive patients. Therefore, there were 259 PC patients.

In TC, 327 patients were visited consecutively during the study period. Of these, 283 patients had an eGFR of 60 mL/min/1.73 m² or less (\(\leq 1.00\) mL/s). We excluded 25 patients with changes in eGFR greater than 30%, 9 patients who were normotensive, 13 patients who had consulted nephrologists, and 10 patients because of both eGFR of 15 mL/min/1.73 m² or less (\(\leq 0.25\) mL/s) and regular follow-up in nephrology. Therefore, there were 259 PC patients.

Forms were completed overall, with the exception of data for 24-hour urine collection that were either missing (n = 60 in PC, n = 28 in TC) or excluded because of inaccurate urine collection (n = 13 in PC, n = 11 in TC). For assessment of renal function, we used the eGFR value calculated by means of the Cockcroft-Gault equation that was available in all patients and strictly correlated with 24-hour measured creatinine clearance (Pearson correlation coefficient, 0.784). Similarly, eGFR calculated by means of the Cockcroft-Gault formula and Modification of Diet in Renal Disease equation strictly correlated (Pearson correlation coefficient, 0.863).

In PC, we found a greater prevalence of elderly persons, women, and patients with diabetes and CV disease (Table 1). Also in this group, number of CV events per patient (0.90 \pm 0.94 versus 0.48 \pm 0.83; \(P < 0.0001\)) and duration of hypertension were significantly greater.

Main laboratory parameters are listed in Table 2. Implementation of a low-sodium diet (\(\leq 100\) mmol/d) was significantly greater in TC than PC (35% versus 22%; \(P = 0.041\)).

All PC physicians correctly answered the questionnaire on BP target in patients with CKD, stating that they were aware of the specific target of less than 130/80 mm Hg. Overall, mean systolic and diastolic BPs were significantly greater in the PC than TC group (Table 3). Specifically, after stratification for age, sex, and diabetic status, BP levels were always lower in TC, except for systolic BP in older patients and those with diabetes. BP levels were lower in patients with CKD stage 3 in TC, whereas no difference was detected in patients with CKD stage 4. In addition, when patients were grouped according to diagnosis of primary renal disease, we detected a difference between PC and TC of 5.5 mm Hg (95% CI, 0.2 to 10.8) and 6.4 mm Hg (95% CI, 0.3 to 12.5) in patients with hypertensive nephropathy and undiagnosed renal disease, respectively. Conversely, no difference was found for patients with diabetic nephropathy and other renal diseases. The prevalence of patients reaching the BP target recommended in patients with CKD was greater in TC than PC (21.5%; 95% CI, 15.6 to 27.4 versus 5.8%; 95% CI, 2.9 to 8.6; \(P < 0.0001\)). This also occurred when patients were stratified according to CKD stage (Fig 1). The difference in reaching the target diminished for the BP target recommended for hypertensive patients with normal renal function (<140/90 mm Hg, 48.4%; 95% CI, 41.2 to 55.6 in TC; and 39.0%; 95% CI, 33.1 to 44.9 in PC; \(P = 0.053\)). Adjusted risk for not achieving the BP target of less than 130/80 mm Hg was 2.6-fold greater in PC, whereas the risk did not differ considering the 140/90–mm Hg target (Table 4). Hosmer-Lemeshow test showed good fit for both models with values of 3.6 (\(P = 0.89\)) and 5.9 (\(P = 0.66\)) for the 130/80– and 140/90–mm Hg targets, respectively.

Fewer antihypertensive drugs were prescribed in PC (1.9 \pm 1.1 versus 2.5 \pm 1.1; \(P < 0.0001\)). In this group, despite high BP levels, 9% of patients were not prescribed any drug (Table 5). Furthermore, 2 or more drugs were prescribed in 66% of PC patients and 83% of TC patients. Agents suppressing renin-angiotensin system activity were the most represented drugs in either group (83% in PC, 78% in TC). Combination treatment with a converting enzyme inhibitor and angiotensin receptor blocker was prescribed in 1.3% and 6.5% of treated patients in the PC.
and TC groups, respectively ($P = 0.01$). The second most prescribed antihypertensive class was diuretics (49% in PC, 55% in TC). However, nephrologists preferentially prescribed loop diuretics (furosemide in all patients), whereas PC physicians almost exclusively prescribed thiazides (hydrochlorothiazide, 94% of thiazide prescriptions). In addition, oral furosemide daily dose was lower in PC than TC (28 ± 21 versus 47 ± 41 mg/d; $P = 0.004$); furosemide was administered at a low dosage (≤25 mg/d) in 86% of PC patients and 55% of TC patients ($P = 0.002$). Similarly, hydrochlorothiazide was prescribed at low dosage (≤12.5 mg/d) in 65 of 74 PC patients (88%); in all these PC patients, hydrochlorothiazide was administered in combination with a converting enzyme inhibitor or angiotensin receptor blocker.

**DISCUSSION**

The main finding of this study is that control of CKD-related hypertension is worse in PC than TC. Mean BP differences between the 2 groups were approximately 7 mm Hg for systolic and 4 mm Hg for diastolic BP. This difference is not trivial; conversely, it can be associated with relevant clinical effects. In patients with CKD enrolled in the Modification of Diet in Renal Disease study, each 10–mm Hg increase in systolic BP was associated with a 35% greater risk

<table>
<thead>
<tr>
<th>Table 1. Clinical Characteristics of Patients With CKD Followed Up in PC and TC Settings</th>
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<tbody>
<tr>
<td><strong>PC (n = 259)</strong></td>
</tr>
<tr>
<td><strong>Age (y)</strong></td>
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<tr>
<td><strong>Male sex (%)</strong></td>
</tr>
<tr>
<td><strong>Body mass index (kg/m²)</strong></td>
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<tr>
<td><strong>Actual smoker (%)</strong></td>
</tr>
<tr>
<td><strong>Diabetes (%)</strong></td>
</tr>
<tr>
<td><strong>Duration of hypertension (mo)</strong></td>
</tr>
<tr>
<td><strong>Patients with prior CV events (%)</strong></td>
</tr>
<tr>
<td><strong>CV comorbidities</strong></td>
</tr>
<tr>
<td><strong>Coronary artery disease (%)</strong></td>
</tr>
<tr>
<td><strong>Stroke (%)</strong></td>
</tr>
<tr>
<td><strong>Peripheral vascular disease (%)</strong></td>
</tr>
<tr>
<td><strong>Primary renal disease</strong></td>
</tr>
<tr>
<td><strong>Hypertensive nephropathy</strong></td>
</tr>
<tr>
<td><strong>Diabetic nephropathy</strong></td>
</tr>
<tr>
<td><strong>Glomerulonephritis/polycystic kidney disease/other</strong></td>
</tr>
<tr>
<td><strong>Unknown</strong></td>
</tr>
</tbody>
</table>

**NOTE.** Values expressed as mean ± SD, percent, or median (range).

<table>
<thead>
<tr>
<th>Table 2. Laboratory Parameters of Patients With CKD Followed Up in PC and TC Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PC (n = 259)</strong></td>
</tr>
<tr>
<td><strong>Serum creatinine (mg/dL)</strong></td>
</tr>
<tr>
<td><strong>Total cholesterol (mg/dL)</strong></td>
</tr>
<tr>
<td><strong>Serum albumin (g/dL)</strong></td>
</tr>
<tr>
<td><strong>Hemoglobin level (g/dL)</strong></td>
</tr>
<tr>
<td><em><em>eGFR</em> (mL/min/1.73 m²)</em>*</td>
</tr>
<tr>
<td><strong>Measured creatinine clearance (mL/min/1.73 m²)</strong></td>
</tr>
<tr>
<td><strong>Proteinuria (mg/d)</strong></td>
</tr>
<tr>
<td><strong>Urinary sodium excretion (mmol/d)</strong></td>
</tr>
</tbody>
</table>

**NOTE.** Values expressed as mean ± SD or median (range). To convert serum creatinine in mg/dL to μmol/L, multiply by 88.4; total cholesterol in mg/dL to mmol/L, multiply by 0.02586; serum albumin and hemoglobin in g/dL to g/L, multiply by 10; eGFR in mL/min to mL/s, multiply by 0.01667.

*Estimated creatinine clearance by means of the Cockcroft-Gault equation.
for hospitalization for CV disease; similar data have been provided by other prospective studies. Furthermore, secondary analysis of the First National Health and Nutrition Examination Survey data suggested, with the limitations intrinsic to the observational design, that the effect on CV outcome determined by a similar BP measurement reduction is strikingly greater in patients with high-risk conditions, including CKD, than in those with uncomplicated hypertension. Conversely, even small changes in BP can significantly affect the rate of CKD progression.

The inadequate management of hypertension in PC was further testified to by the observation that approximately 94% of patients had BP values greater than the 130/80-mm Hg target, whereas in TC, this occurred in 79%. Different BP control persisted after adjustment for the main unmodifiable risk factors; the adjusted risk for not having optimal BP was approximately 3-fold greater in PC. In this regard, it is important to emphasize that patients with CKD referring to PC physicians were more complicated than those followed up by nephrologists. It is reasonable to hypothesize that the greater CV risk of PC patients, although requiring more intensive treatment of hypertension, paradoxically led to less adequate intervention because of the fear of adverse effects.

To support this hypothesis, we performed a second multivariate analysis using the BP target recommended for patients with essential hypertension.

<table>
<thead>
<tr>
<th>Table 3. BP in Patients With CKD Followed Up in PC and TC According to Age, Sex, and Diabetic Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PC</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>All patients</td>
</tr>
<tr>
<td>Old (≥65 y)</td>
</tr>
<tr>
<td>Young (&lt;65 y)</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Diabetes</td>
</tr>
<tr>
<td>No diabetes</td>
</tr>
<tr>
<td>CKD stage 3</td>
</tr>
<tr>
<td>CKD stage 4</td>
</tr>
</tbody>
</table>

NOTE. Values expressed as mean ± SD.
*P < 0.0001 versus TC.
†P < 0.005 versus TC.
‡P < 0.05 versus TC.
tension (<140/90 mm Hg). We found that, different from the analysis performed with the BP target for patients with CKD, adjusted risks for not achieving the 140/90–mm Hg target were no longer different between patients treated by family physicians and nephrologists (Table 4). This finding suggests that PC physicians basically treated nephropathic patients as essential hypertensives. This attitude was possibly determined, at least in part, by the use for assessment of renal function of the sole serum creatinine value, which does not allow proper quantification of the severity of CKD. Of note, also in TC, BP management was largely unsatisfactory; the target was achieved in only 21% of patients. It is well known that optimal BP control represents a difficult task in patients with CKD, likely because of extracellular volume expansion combined with enhanced activity of the renin-angiotensin and sympathetic systems.4,22,23

Comprehensive analysis of antihypertensive treatment identifies 3 areas for potential improvement in BP control in the PC setting. First, PC physicians less frequently prescribed multidrug therapy. Conversely, expert panels recommend prescription of 2 or more antihypertensive agents to reach the lower BP goals in patients with CKD.1,16 Second, diuretic therapy was inappropriate in PC considering type and dose of diuretic. Although loop diuretics are the first choice in patients with renal insufficiency, PC physicians showed a preference for thiazides, for which efficacy is impaired progressively when creatinine clearances decline to less than 50 mL/min (<0.83 mL/s).22,24 Furthermore, in the PC group, furosemide was administered at doses certainly inadequate for the level of

<table>
<thead>
<tr>
<th>Variable</th>
<th>Patients With CKD (&lt;130/80 mm Hg)</th>
<th>Patients With Essential Hypertension (&lt;140/90 mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Odds Ratio 95% CI P</td>
<td>Odds Ratio 95% CI P</td>
</tr>
<tr>
<td>PC v TC</td>
<td>2.60 1.30-5.19 0.006</td>
<td>1.24 0.80-1.91 0.332</td>
</tr>
<tr>
<td>Age (10 y)</td>
<td>1.34 1.06-1.70 0.013</td>
<td>1.01 0.85-1.21 0.879</td>
</tr>
<tr>
<td>Sex (male v female)</td>
<td>0.54 0.28-1.04 0.065</td>
<td>0.68 0.46-1.01 0.060</td>
</tr>
<tr>
<td>Diabetes (yes v no)</td>
<td>1.71 0.80-3.68 0.168</td>
<td>1.75 1.13-2.71 0.012</td>
</tr>
<tr>
<td>eGFR (1 mL/min/1.73 m²)</td>
<td>1.02 0.99-1.05 0.087</td>
<td>1.01 0.99-1.03 0.351</td>
</tr>
<tr>
<td>Duration of hypertension (3 y)</td>
<td>1.10 0.97-1.25 0.144</td>
<td>1.01 0.94-1.08 0.727</td>
</tr>
</tbody>
</table>

NOTE. BP target for patients with CKD, less than 130/80 mm Hg; for patients with essential hypertension, less than 140/90 mm Hg. To convert GFR in mL/min to mL/s, multiply by 0.01667.

**Table 5. Number of Antihypertensives and Antihypertensive Class Distribution in Patients With CKD Followed Up in PC and TC**

<table>
<thead>
<tr>
<th>No. of drugs (% of patients)</th>
<th>PC (n = 259)</th>
<th>TC (n = 186)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>9.3</td>
<td>0.5</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>1</td>
<td>24.7</td>
<td>16.2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>40.5</td>
<td>36.0</td>
<td></td>
</tr>
<tr>
<td>≥3</td>
<td>25.5</td>
<td>47.3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classes of drugs (% of treated patients)</th>
<th>PC (n = 259)</th>
<th>TC (n = 186)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Converting enzyme inhibitors</td>
<td>58.3</td>
<td>57.8</td>
<td>0.924</td>
</tr>
<tr>
<td>Angiotensin receptor blockers</td>
<td>26.4</td>
<td>26.5</td>
<td>0.981</td>
</tr>
<tr>
<td>Loop diuretics</td>
<td>15.3</td>
<td>44.3</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Thiazide diuretics</td>
<td>34.9</td>
<td>9.7</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Calcium channel blockers</td>
<td>43.0</td>
<td>48.7</td>
<td>0.201</td>
</tr>
<tr>
<td>β-Blockers</td>
<td>17.0</td>
<td>28.6</td>
<td>0.006</td>
</tr>
<tr>
<td>α-Blockers</td>
<td>7.7</td>
<td>22.2</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Others</td>
<td>7.2</td>
<td>8.6</td>
<td>0.725</td>
</tr>
</tbody>
</table>
renal function. Similarly, the vast majority of PC patients were administered a low hydrochlorothiazide dose; in most patients, this agent was prescribed in combination with either converting enzyme inhibitor or angiotensin receptor blocker, therefore making upward titration of the dosage impossible. Conversely, in the presence of moderate renal impairment, as in the case of these patients, maintenance doses of both furosemide and hydrochlorothiazide should be at least doubled to efficaciously reduce extracellular volume expansion.22,24

The third aspect to take into account concerns dietary salt restriction, recognized as the basic approach in hypertensive patients.16 With respect to PC, in the nephrology outpatient clinic, a greater number of patients were compliant with a low-sodium diet. In patients with CKD, this dietary intervention becomes even more critical because of the marked salt sensitivity of BP, and it is essential to maximize the antihypertensive effectiveness of nephroprotective drugs.22 However, we cannot exclude that greater use of α-blockers in TC may have contributed to better BP control. Similarly, greater prescription of β-blockers may have counteracted the enhanced adrenergic activity that is common in these patients.22,23

Conversely, PC physicians correctly chose the first-line antihypertensive agent. According to recommendations on antihypertensive treatment in patients with CKD,1,2,16,22 family physicians prescribed drugs inhibiting renin-angiotensin system activity in the large majority of patients.

The main limitations of this study are strictly dependent on the observational design; potential bias may arise when comparing 2 nonmatched groups despite adjustment for the main clinical difference. However, this problem is reasonably overcome by the greater CV risk in PC that would have required BP control even more intensive than in TC.21 Furthermore, we evaluated prescription, but not adherence to therapy. However, this potential bias becomes less critical considering that prescription per se was inadequate in PC. Nevertheless, the effectiveness and safety of more intensive antihypertensive treatment needs to be verified by prospective studies.

No previous study has specifically evaluated the quality of control of CKD-related hypertension in PC; the scarce available information can only be extrapolated by studies that did not primarily focus on BP control. Harris et al25 performed a randomized controlled study in early 1990, when the importance of tight BP control was not yet emphasized. Investigators considered a BP of 145/80 mm Hg as a “good” level, and use of converting enzyme inhibitors was negligible. Similarly, a retrospective analysis showed poor control of hypertension in a small group of patients with CKD followed up in PC, but the study was not controlled and no evaluation of antihypertensive therapy was obtained.26 More recently, proper BP control was reported in patients with CKD at nephrology referral27; however, these patients also were followed up by other specialists, and no comparison with a nephrology setting was performed.

In conclusion, this survey provides a comprehensive comparison between PC and TC of BP control in patients with CKD and identifies opportunities for improving the management of CKD-related hypertension in PC. Patients exclusively followed up by PC physicians showed greater BP levels despite greater CV risk. This difference likely was related to the low number of antihypertensive drugs prescribed and inadequate diuretic therapy. These data support the need for an educational program for family physicians on the basic care of patients with CKD that includes management of hypertension.

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APPENDIX

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