Blood Pressure Control and Physician Management of Hypertension in Hospital Hypertension Units in Spain

José R. Banegas, Julián Segura, Luis M. Ruilope, Manuel Luque, Rafael García-Robles, Carlos Campo, Fernando Rodríguez-Artalejo, Juan Tamargo, on behalf of the CLUE Study Group Investigators

Abstract—Goal blood pressure (BP) was defined by the Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-VI) and the World Health Organization–International Society of Hypertension (WHO/ISH) as <140 mm Hg systolic and <90 mm Hg diastolic for the general population. For high-risk and special high-risk populations, a more rigorous goal BP was defined by the Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-VI) and the World Health Organization–International Society of Hypertension (WHO/ISH) as <130 mm Hg systolic and <85 mm Hg diastolic. In 47 hospital-based hypertension units in Spain, the percentage of well-controlled patients (BP goal achieved) was extremely low (2%) in patients with proteinuria >1 g/d. Poorer BP control was observed among patients at high risk, with diabetes, renal disease, or obesity, than in lower-risk groups. BP control was lower for systolic than for diastolic BP. In >50% of uncontrolled patients, no measures were taken by doctors to optimize pharmacologic treatment, and approximately one-third of patients were still using drug monotherapy. Control of BP, particularly of systolic BP, is still far from optimal in hospital-based hypertension units. Patients at high risk, with diabetes or proteinuria, warrant focused attention. Moreover, a more aggressive behavior of doctors treating uncontrolled hypertension is needed.

Key Words: blood pressure ■ arterial hypertension ■ cardiovascular diseases ■ arterial pressure

Epidemiological surveys have revealed that blood pressure (BP) control is adequate (<140 mm Hg systolic BP [SBP] and <90 mm Hg diastolic BP [DBP]) in only a small percentage of the hypertensive population. Information on BP control in hospital-based hypertension units is scarce, ye the percentage of well-controlled patients (<140 mm Hg SBP and <90 mm Hg DBP) seems to be significantly higher in comparison with data obtained in primary care clinics.

For some selected populations facing higher risk, especially for those with diabetes or renal disease, the Sixth Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-VI) and the World Health Organization–International Society of Hypertension (1999 WHO/ISH) guidelines established or suggested the adequacy of a goal BP <130/85 mm Hg. It was also suggested that treating a lower target BP (<130 SBP and <85 DBP) than that for most hypertensives (<140 SBP and <90 DBP) may be useful to prevent stroke, to prevent or slow heart failure progression, to alleviate persistent angina, or if there is compelling cardiovascular indication. Therefore, a lower BP goal may be indicated for groups of hypertensive patients in JNC-VI risk group C, as well as for patients stratified under the 1999 WHO/ISH guidelines as very high-risk or high-risk.

Nevertheless, there are few reports that address BP control among these special subgroups of hypertensives by reference to their targeted BP. Furthermore, because the JNC-7 and 2003 European Society of Hypertension/European Society of Cardiology (ESH/ESC) guidelines have recently been released and because they differ somewhat from JNC-VI and WHO/ISH guidelines, it may be of interest to consider the new, more aggressive goal BP <130/80 for those special populations (diabetes, renal disease). Finally, the behavior of physicians attending uncontrolled hypertensives has attracted
recent attention\textsuperscript{14,15} and is perceived as a factor that may influence BP control in hospital-based hypertension units.

This is the first study in Spain to our knowledge to report on the degree of BP control achieved in hospital-based hypertension units across the whole nation in light of recommendations contained in international guidelines and that analyzes physician behavior toward patients with uncontrolled BP.

**Methods**

We performed a survey covering patients, aged 18 years or older, who had a diagnosis of essential hypertension, had been using antihypertensive therapy for \( \geq 1 \) year, had been seen at 47 hospital-based hypertension units nationwide, and had been regularly followed-up by the same medical team in each unit.

All patients who met the inclusion criteria were included in the study only once during a 2-month period (May to June 2000) (\( n=4049 \)). Patients with secondary hypertension and those who attended the first visit to the hospital unit on treatment prescribed by their family physicians were excluded.

Spanish hospital-based hypertension units are outpatient clinics located at hospitals that mostly belong to the National Health Service and tend to be the setting to which most patients are referred by primary care physicians in the event of difficult-to-manage hypertension. Such units are staffed by 2 to 4 physicians and 1 to 3 nurses trained as specialists in clinical hypertension. All patients were seen by the attending physician or nurse at each visit. No specific protocol was followed, but each physician was guided by the target of reducing BP in accordance with international guidelines.\textsuperscript{9–15} This study was approved in all cases by the Institutional Review Board at the participating hospitals, and informed consent was obtained from patients.

After a 5-minute rest, BP was determined in the seated position by a hospital-unit physician using appropriately sized cuffs and calibrated standard mercury sphygmomanometers. Korotkoff phases 1 and 5 were taken as SBP and DBP, respectively. Two measurements were performed at an interval of 5 minutes, with the mean of the 2 readings being deemed as defining the patient’s BP.

Additional data were collected from a structured questionnaire completed by the physician at the time of the study visit. This form contained items covering demographic data, accompanying cardiovascular risk factors, evidence of target organ damage, and previously diagnosed clinical cardiovascular disease (CCD) (myocardial infarction, angina, stroke, heart failure). Hypercholesterolemia was defined as total serum cholesterol \( >220 \) mg/dL or presence of current hypolipemic therapy. Obesity was defined as body mass index (BMI) \( \geq 30 \) kg/m\(^2\), and overweight was defined as BMI 25 to 30 kg/m\(^2\). Diabetes mellitus was defined as fasting blood glucose repeatedly \( \geq 126 \) mg/dL or current antidiabetic therapy. Microalbuminuria was defined as average urinary albumin excretion in two 24-hour periods of 30 to 300 mg daily, and proteinuria was defined as total serum creatinine \( >1.5 \) mg/dL. Left ventricular hypertrophy was defined as left ventricular mass index calculated from an M-mode echocardiogram (obtained in \( \sim 50\% \) of patients) \( >125 \) g/m\(^2\) or presence of electrocardiographic criteria (Sokoloff index \( >35 \) mm). Renal insufficiency was diagnosed when serum creatinine was \( >1.5 \) mg/dL in men and \( >1.4 \) mg/dL in women, or when proteinuria was present. Clinical parameters were defined and determined using standardized methods and conditions.\textsuperscript{9,10,16} Biochemical parameters corresponded to the last determination at the unit. Current use of different classes of drugs was likewise evaluated. In addition, physicians were asked whether they had prescribed a modification of hypertension treatment (and type of modification) for each patient after the visit (ie, after analysis of the BP reading taken at the visit).

Goal BP was defined as values \( <140/90 \) mm Hg for the general hypertensive population\textsuperscript{9,10,12,13} and \( <130/85 \) for special populations (diabetes, renal disease).\textsuperscript{9,10} We have also considered a goal BP \( <120/80 \) for hypertensives with diabetes or renal disease, according to the most recent guidelines.\textsuperscript{12,13} To describe how the data relate to this change in goal BP. Finally, BP control was also calculated for those patients stratified under the 1999 WHO/ISH guidelines as very high-risk or high-risk and medium/low-risk,\textsuperscript{10} as well as for patients in JNC-VI risk group C and risk groups A and B.\textsuperscript{9}

Descriptive methods were used for analysis of all study variables. The relationships between BP control and other risk factors were analyzed using multiple logistic regression, with \( P<0.05 \) taken as statistical significance.

**Results**

Baseline data for the 4049 hypertensives studied are shown in Table 1. Mean BP was 178 \( \pm 15/104 \pm 11 \) mm Hg when first seen at the units, and 144 \( \pm 20/85 \pm 10 \) mm Hg when estimated for the survey.

**Selected Populations at Risk and Stratification by Risk**

Patients with diabetes and patients with renal disease were characterized as being older, having higher BMI, higher SBP,
Age, BMI, SBP, and cardiovascular risk were higher in these patients than in those with a medium/low risk (Table 2).

**BP Control and Drugs Used**

At the date of the survey, BP values were <140 and 90 mm Hg in 1702 patients (42%). BP control in terms of the 140/90 mm Hg goal was achieved in 36.7% of patients with diabetes. However, only 13.2% reached the more stringent JNC-VI and 1999 WHO/ISH guideline goal (<130 SBP and <85 DBP), and only 10.5% achieved the even more rigorous

**TABLE 3. Blood Pressure Control (%) Among Hypertensives by Risk Groups and Guidelines**

<table>
<thead>
<tr>
<th>Risk Group According to Guidelines</th>
<th>Blood Pressure Target (SBP/DBP)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;140/90 mm Hg</td>
</tr>
</tbody>
</table>

- Percentages in bold refer to the appropriate figure for each risk group according to the corresponding guideline BP goal. Other values are given for reference.
- *Figure corresponding to the BP goal for the general hypertensive population according to all guidelines.
- †Figure corresponding to the BP goal for diabetes and kidney disease according to JNC-VI and 1999 WHO/ISH guidelines.
- ‡Figure corresponding to the BP goal for diabetes and kidney disease according to JNC-7 and 2003 ESH/ESC.
JNC-7 and 2003 ESH/ESC guideline goal (<130 SBP and 80 DBP) (Table 3). These percentages were significantly lower than those in nondiabetic subjects. Among hypertensive patients with kidney disease, BP control <140 SBP and <90 DBP, <130 SBP and <85 DBP, and <130 SBP and <80 DBP (all mm Hg) was achieved in 35.5%, 17%, and 12.4%, respectively (Table 3). Again, these percentages were significantly lower than those in patients without kidney disease.

BP control <130 SBP and <85 DBP (mm Hg) was attained by 18.5% of patients with microalbuminuria. A total of 17% of patients with proteinuria of 30 to 1000 mg/d achieved a BP control <130 SBP and <85 (DBP) (mm Hg) (goal of JNC-VI). According to the JNC-7 and ESH/ESC guidelines, goal BP <130 SBP and <80 (DBP) (mm Hg) was achieved by 12% of patients with proteinuria >300 mg/d. Finally, for proteinuria >1 g/d, the BP goal is <125 SBP and <75 DBP (mm Hg) for all guidelines, and this BP value was attained by only 2.4% of these patients.

Regarding BP control among hypertensive patients stratified by total cardiovascular risk, a BP goal <130 SBP and <85 (DBP) (mm Hg) was attained by only 18% of patients in JNC-VI risk group C and 17% of WHO-ISH very high-risk and high-risk patients (Table 3). Both percentages were significantly lower than those in lower-risk groups (Table 3).

In all cases, ie, the total hypertensive population and the risk groups, BP control rates were significantly lower for SBP than for DBP (Table 4).

The univariate analysis showed that poorer BP control occurred in older patients, females, obese patients, diabetic patients, and in those treated with ≥2 antihypertensive drugs (Table 5). Interestingly, patients with diabetes or renal disease were using, on average, 2.3 antihypertensive medications versus 1.9 taken by those who had no diabetes/no renal disease (P<0.05). The percentage of hypertensive patients using diuretics, angiotensin-converting enzyme inhibitors (ACEIs) and calcium channel blockers (CCBs) was significantly higher in those with diabetes or renal disease (41%, 50%, and 52%, respectively) than in their nondiabetic/nonrenal disease counterparts (33%, 36%, and 38%, respectively). In the multivariate analysis, all variables, except for gender, remained statistically significant (P<0.05).

Concerning treatment, 34.6% of patients were using drug monotherapy, and 63.7% were using ≥2 drugs. Only 1.7% were treated without drugs but were strongly urged to adopt lifestyle changes. ACEIs, angiotensin II receptor antagonists (ARA II), and CCBs were the drugs most frequently prescribed on monotherapy (31.6%, 17.9%, and 17.0%, respectively), followed by β-blockers (10.4%), diuretics (4.9%), and α-blockers (4.4%). In combination, the drug associations most frequently prescribed were: ACEI plus CCB (9.4%); ACEI plus diuretic (7.9%); ACEI plus CCB plus diuretic (7.1%); ARA II plus CCB (5%); ARA II plus diuretic (4.6%); and ARA II plus CCB plus diuretic (3.1%). Diuretics was the therapeutic group most frequently used in combination (29.5%), followed by CCB (24.6%) and ACEI (22.2%).

### TABLE 4. Systolic and Diastolic Blood Pressure Control of Special Populations as per Guidelines

<table>
<thead>
<tr>
<th>Population BP Goal</th>
<th>SBP/DBP At Goal (%)</th>
<th>SBP At Goal (%)</th>
<th>DBP At Goal (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total population</td>
<td>4049</td>
<td>42</td>
<td>17</td>
</tr>
<tr>
<td>&lt;140/90 mm Hg</td>
<td>13</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>Diabetic patients</td>
<td>&lt;130/85 mm Hg</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Renal failure</td>
<td>&lt;130/85 mm Hg</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td>Proteinuria</td>
<td>&lt;130/80 mm Hg</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>&lt;125/75 mm Hg†</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>
| Percentages are rounded to the nearest whole number.  
*For proteinuria 30 to 1000 mg/d according to JNC-VI guidelines.  
†For proteinuria >300 mg/d according to JNC-7 and 2003 ESH/ESC guidelines.  
‡For proteinuria >1 g/d according to all guidelines.

### TABLE 5. Systolic and Diastolic Blood Pressure Control by Subgroup

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>SBP/DBP &lt;140/90 mm Hg (%)</th>
<th>SBP &lt;140 mm Hg (%)</th>
<th>DBP &lt;90 mm Hg (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;60</td>
<td>2006</td>
<td>48</td>
<td>55</td>
</tr>
<tr>
<td>≥60</td>
<td>2043</td>
<td>36</td>
<td>38</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2001</td>
<td>42</td>
<td>47</td>
</tr>
<tr>
<td>Female</td>
<td>2048</td>
<td>41</td>
<td>46</td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>893</td>
<td>37</td>
<td>39</td>
</tr>
<tr>
<td>No</td>
<td>3156</td>
<td>43</td>
<td>49</td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 drug</td>
<td>1401</td>
<td>48</td>
<td>54</td>
</tr>
<tr>
<td>≥2 drugs</td>
<td>2579</td>
<td>39</td>
<td>43</td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;30 kg/m²</td>
<td>2385</td>
<td>46</td>
<td>50</td>
</tr>
<tr>
<td>≥30 kg/m²</td>
<td>1664</td>
<td>34</td>
<td>39</td>
</tr>
</tbody>
</table>

Percentages are rounded to the nearest whole number.
cation were higher in high-risk groups than in lower-risk
groups. Finally, doctors who modified treatment did so
mainly by adding another drug or, alternatively, by increasing
the dose of the initially selected drug (Table 6).

**Discussion**

Our data confirm that hypertensive patients followed-up in
hospital hypertension clinics, especially those with diabetes
or kidney disease or those in high-risk groups, exhibit an
elevated level of cardiovascular risk linked to a high preva-
ience of target organ damage, CCD, diabetes, or other major
CCD risk factors, a risk that is much higher than that
observed for general populations. Hence, the hypertensive
study population is characterized by the need for strict BP
control.

In accordance with other studies, we observed the
percentage of patients attaining a BP level \( \leq 140/90 \) mm Hg
in hospital-based or specialized hypertension units to be
significantly better than that obtained in population-based
surveys or primary health care.

Under the most recent guidelines on hypertension manage-
ment, only 10% of diabetic patients and 12% of renal
disease patients had their BP controlled. These figures are
clearly lower than those corresponding to the <130 SBP and
<85 DBP (mm Hg) goal of previous guidelines enforced
at the time of the survey and accentuate further the need for
better control in these selected populations. BP control (<125
SBP and <75 DBP mm Hg) is extremely low (2%) in those
hypertensive patients with proteinuria >1 g/d.

Interestingly, despite the fact that BP control was rather
similar between the US and European guideline high-risk
(18% and 17%, respectively) and low-risk groups (46.1% and
46.4%, respectively), high-risk patients displayed lower BP
control than did low-risk patients. This fact has also been
observed in other studies, and the reason may be that
high-risk patients tend to include the elderly and those with
higher pretreatment BP who are inherently more difficult to
control. This finding also evidences that those hypertensive
patients who most needed their BPs to be controlled because
they were at higher risk were precisely the ones most
disadvantaged in terms of BP control. This is true even when
high-risk and lower-risk groups are compared within the
same BP goal. This also applies to those with diabetes or
renal disease, whose BP control is lower than that in nondi-
abetic/nonrenal disease patients.

**Predictors of BP control** have been investigated in various
studies, and the presence of target organ damage, CCD, and
diabetes invariably figure among the best predictors of poor BP
control. Findings that were replicated in our study. These
high-risk groups impose the need to attain a lower goal (<130 SBP and
<80 to 85 DBP mm Hg) in accordance with the guidelines, which in turn
leads to the percentage of good control decreasing
significantly to as low as ~20%, and lower still among diabetic
patients. Different reasons may underlie this finding.

<table>
<thead>
<tr>
<th>TABLE 6. Physicians Behavior in Uncontrolled Hypertension According to Guideline Risk Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Group According to Guidelines</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Special populations</td>
</tr>
<tr>
<td>Diabetes %</td>
</tr>
<tr>
<td>No diabetes with BP ( \geq 140/90 ) (n=1784)</td>
</tr>
<tr>
<td>Diabetes with BP ( \geq 130/85 ) (n=775)</td>
</tr>
<tr>
<td>Diabetes with BP ( \geq 130/80 ) (n=799)</td>
</tr>
<tr>
<td>Kidney disease %</td>
</tr>
<tr>
<td>No kidney disease with BP ( \geq 140/90 ) (n=1916)</td>
</tr>
<tr>
<td>Kidney disease with BP ( \geq 130/85 ) (n=555)</td>
</tr>
<tr>
<td>Kidney disease with BP ( \geq 130/80 ) (n=586)</td>
</tr>
<tr>
<td>Total risk %</td>
</tr>
<tr>
<td>1997 JNC-VI</td>
</tr>
<tr>
<td>Risk group A + B with BP ( \geq 140/90 ) (n=559)</td>
</tr>
<tr>
<td>Risk group C with BP ( \geq 130/85 ) (n=2469)</td>
</tr>
<tr>
<td>1999 WHO/ISH</td>
</tr>
<tr>
<td>Medium and low risk with BP ( \geq 140/90 ) (n=809)</td>
</tr>
<tr>
<td>Very high and high risk with BP ( \geq 130/85 ) (n=2107)</td>
</tr>
</tbody>
</table>

Percentages are rounded to the nearest whole number.
For definitions of risk factors and risk groups, see Methods.
First, attainment of such a low goal BP, especially of SBP, is difficult with available drugs, particularly in patients with these characteristics. In fact, two-thirds of our patients were being treated with combinations including ≥2 drugs. Although the percentage of hypertensive patients using diuretics, alone (1.7%) or in combination (29.5%), was only less than the percentage using ACEI (33.1%), diuretics (mostly of thiazide-type) were the antihypertensive group most frequently used in combination.

Second, Spanish physicians attached to hospital hypertension units are disinclined to adopt more aggressive therapeutic management to improve BP control in many uncontrolled BP patients. Indeed, these physicians introduced therapeutic modifications in less than half of the patients with inadequate BP control (as low as 38% among high-risk patients). Interestingly, this reluctance to modify treatment was more marked among individuals in high-risk groups or with diabetes or renal disease (as high as 60% to 62%) than in lower-risk groups (52% to 59%). That is, clinical inertia was higher in groups of uncontrolled hypertensives that needed to have their treatment modified more than did other patients. These figures of drug treatment modification, although higher than those seen in general practice, are unexpectedly low at hospital-based hypertension clinics. Although almost half of all treatment modification consisted of introducing a drug association, a single-drug strategy was nevertheless main-

Third, more effective implementation of physicians’ knowledge concerning the need to control BP at goal levels in the majority of patients seen at hospital units is probably required. Although we lack data to confirm this possibility, it nevertheless seems reasonable to assume that enhanced knowledge will contribute to improved BP control. Finally, it is also possible that the guideline recommendations may be unrealistic, at least in the case of high-risk patients. In this regard, no study to our knowledge has yet been undertaken in which this question has yet been answered.

In summary, hospital-based hypertension units follow-up a population of hypertensive patients characterized by very high cardiovascular risk. Consequently, intervention must be integrated and include control of many different factors. Among these, strict control of BP, and SBP in particular, is the goal that, according to our data, still needs to be clearly improved. In particular, patients at high risk for CVD, with diabetes, renal disease, proteinuria, or obesity, warrant focused attention. Moreover, to improve BP control, more aggressive behavior on the part of doctors treating uncontrolled hypertension would seem to be called for, especially for those at higher risk.

Appendix

Investigators on Behalf of the CLUE Study

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Acknowledgments

Main funding for the study was obtained from Bristol-Myers Squibb through an unrestricted educational grant. The funding body had no role in the collection, analyses, or interpretation of data, or in the decision to submit the paper for publication.

References

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Hypertension. 2004;43:1338-1344; originally published online April 26, 2004;
doi: 10.1161/01.HYP.0000127424.59774.84

Hypertension is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0194-911X. Online ISSN: 1524-4563

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