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Cardiovascular Outcome in Treated Hypertensive Patients with Responder, Masked, False Resistant, and True Resistant Hypertension

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Background: The aim of this study was to evaluate the cardiovascular outcome in apparently responder hypertensive patients with responder and masked hypertension, and in apparently resistant hypertensive patients with false and true resistant hypertension.

Methods: The occurrence of fatal and nonfatal cardiovascular events was evaluated in 340 patients with responder hypertension (clinic blood pressure [BP] <140/90 mm Hg and daytime BP <135/85 mm Hg), 126 with masked hypertension (clinic BP <140/90 mm Hg and daytime BP >135 or 85 mm Hg), 146 with false resistant hypertension (clinic BP ≥140 or 90 mm Hg and daytime BP <135/85 mm Hg), and 130 with true resistant hypertension (clinic BP ≥140 or 90 mm Hg and daytime BP >135 or 85 mm Hg).

Results: During follow-up period (4.98 ± 2.9 years), the event-rate per 100 patient-years was 0.87, 2.42, 1.2, and 4.1 in patients with responder, masked, false resistant, and true resistant hypertension, respectively. After adjustment for several covariates, including clinic BP (forced into the model), Cox regression analysis showed that cardiovascular risk was significantly higher in masked hypertension (masked versus responder hypertension, relative risk [RR] 2.28, 95% confidence interval [CI] 1.1–4.7, $P < .05$) and in true resistant hypertension (true resistant versus responder hypertension, RR 2.94, 95% CI 1.02–8.41, $P < .05$), whereas there was no significant difference between false resistant and responder hypertension.

Conclusions: This study shows that patients with masked hypertension are at higher risk than those with responder hypertension, and that those with false resistant hypertension are at lower risk than those with true resistant hypertension. Ambulatory BP monitoring should be performed in treated hypertensive patients to obtain a better prognostic stratification. Am J Hypertens 2005;18: 1422–1428 © 2005 American Journal of Hypertension, Ltd.

Key Words: Ambulatory blood pressure, clinic blood pressure, resistant hypertension, prognosis.

The use of ambulatory blood pressure (BP) monitoring has given the opportunity to detect subjects with normal clinic but high ambulatory BP, that is, isolated ambulatory hypertension or masked hypertension.[1–4] Cross-sectional reports have indicated that subjects with masked hypertension show greater organ damage than those with normal clinic and ambulatory BP.[1,2] Moreover, it has been recently reported that subjects with masked hypertension are at increased cardiovascular risk when compared with those with normal clinic and ambulatory BP.[5]

See related article on page 1429

According to our experience and that of other investigators,[6] masked hypertension, as well as responder hypertension (ie, normal clinic and ambulatory BP), may occur in treated hypertensive patients apparently responsive to therapy.

Although in the study by Clement et al[6] this phenomenon has been partly described, at present there are no specific reports in the literature about the prognostic relevance of masked hypertension evaluated by ambulatory BP monitoring in treated subjects.

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Another not uncommon problem observed in the clinical practice is resistant hypertension. It is usually defined as the failure to achieve goal BP despite standard triple therapy.[7–10] Resistant hypertension may be due to several causes and may show a variable prevalence depending on different factors.[7–10]

It has been reported, however, that a number of treated hypertensive patients show a substantial white coat effect during the clinic visit leading to an overestimation of their real BP.[11–16] We[14] and other reseachers[11,15,16] have formerly reported that this phenomenon may be responsible for a false diagnosis of resistant hypertension and have defined this condition as white coat resistant or false resistant hypertension (ie, high clinic but normal ambulatory BP) in contrast to true resistant hypertension (ie, high clinic and ambulatory BP).

To the best of our knowledge, there is at present a single study in the literature reporting the prognostic impact of ambulatory BP in patients with apparently refractory hypertension.[17] In this pioneering study by Redon et al,[17] however, only diastolic BP was used for the classification of patients and there was no attempt to define a group with normal ambulatory BP and to evaluate its cardiovascular risk.

Thus, other data are needed to better appreciate the prognostic relevance of ambulatory BP, both in patients who are apparently responder and in those with apparently resistant hypertension.

The aim of this study was to evaluate cardiovascular outcome in treated hypertensive patients with responder, masked, false resistant, and true resistant hypertension.

Methods

Subjects

Among 466 patients with apparently responder hypertension, we identified 340 with responder hypertension (normal clinic and ambulatory BP; see later for definitions) and 126 with masked hypertension (normal clinic but high ambulatory BP), and among 276 patients with apparently resistant hypertension, we identified 146 with false resistant hypertension (high clinic but normal ambulatory BP) and 130 with true resistant hypertension (high clinic and ambulatory BP). These subjects were selected from a larger treated hypertensive population (1715 patients) submitted to ambulatory BP monitoring. Patients with secondary hypertension were excluded from this study. All the patients underwent clinical evaluation, routine laboratory tests, electrocardiographic (ECG) and echocardiographic examinations, and noninvasive ambulatory BP monitoring. Study population came from the same geographic area (Chieti and Pescara, Abruzzo, Italy). The study was in accordance with the Second Declaration of Helsinki and was approved by the institutional review committee. Subjects gave informed consent.

Office BP Measurements

Clinic systolic and diastolic BP recordings were performed, according to the standard technique, by a physician with the subject in the supine position after 10 min of rest, using a mercury sphygmomanometer. Measurements were performed in triplicate, 2 min apart, and the average value was used as the BP for the visit. Responder hypertension was defined as clinic BP $<$140/90 mm Hg and resistant hypertension was defined as clinic systolic BP $\geq$140 mm Hg or diastolic BP $\geq$90 mm Hg despite triple therapy, in at least two visits.

Ambulatory BP Monitoring

Ambulatory BP monitoring was performed with a SpaceLabs 90207 recorder (SpaceLabs, Redmond, WA) on a day of typical activity. Technical aspects have been previously reported.[18] Ambulatory BP readings were obtained at 15-min intervals from 6 AM to midnight, and at 30-min intervals from midnight to 6 AM. The following ambulatory BP parameters were evaluated: average daytime (awake period), night-time (asleep period), and 24-h systolic and diastolic BP. Awake and asleep periods were calculated from diary times. Recordings were automatically edited if systolic BP was $>$260 or $<$70 mm Hg or if diastolic BP was $>$150 or $<$40 mm Hg and pulse pressure was $>$150 or $<$20 mm Hg.[18] Subjects included in the study had recordings of good technical quality (at least 70% of valid readings). The cut-off of 135/85 mm Hg was used to define normal daytime BP.[19]

Echocardiography

End-systolic and end-diastolic measurements of interventricular septal thickness, left ventricular (LV) internal diameter, and posterior wall thickness were made according to the American Society of Echocardiography recommendations.[20] The LV mass was calculated using the formula introduced by Devereux et al.[21] Individual values for LV mass were indexed by height$^{2.7}$ and LV hypertrophy was defined as LV mass/height$^{2.7}$ $>$50 g/m$^{2.7}$ in men and $>$47 g/m$^{2.7}$ in women.[22]

Follow-up

Subjects were followed-up in our hospital outpatient clinic or by their family doctors. Patients' characteristics and the occurrence of cardiovascular events were recorded during follow-up visits or by telephone interview of the patient followed by a clinical visit. Hospital record forms were collegially reviewed by the authors of this study. Cardiovascular events included fatal and nonfatal myocardial infarction (at least two of three standard criteria: typical chest pain, ECG changes, transient elevation of myocardial enzymes by more than twofold the upper normal limits), coronary or peripheral revascularization (bypass surgery or angioplasty), heart failure requiring hospitalization (at least two major or one major plus two minor

Table 1. Characteristics and blood pressure of study groups

Parameter	Responder Hypertension	Masked Hypertension	False Resistant Hypertension	True Resistant Hypertension
n	340	126	146	130
Men (n [%])	129 (38)	70 (55.5)*	66 (45)	73 (56)*
Age (yr)	59 ± 10	59 ± 12	61 ± 10	61 ± 12
BMI (kg/m^2)	27.7 ± 4	28 ± 4	28.7 ± 4.7	28.7 ± 3.7
Smokers (*n* [%])	62 (18.2)	29 (23)	28 (19.2)	29 (22.3)
FHPCVD (*n* [%])	22 (6.5)	11 (8.7)	10 (6.8)	9 (6.9)
LDL-C (mg/dL)	126.5 ± 29	126 ± 27	129.8 ± 28	128.8 ± 29
Creatinine (mg/dL)	0.84 ± 0.16	0.86 ± 0.19	0.85 ± 0.2	1.04 ± 0.4*†‡
LVH (*n* [%])	46 (13.5)	29 (23)*	22 (15.1)	65 (50)*†‡
Diabetes (*n* [%])	11 (3.2)	5 (4.0)	8 (5.5)	18 (13.8)*†‡
Previous CVE (*n* [%])	4 (1.2)	1 (0.8)	4 (2.7)	7 (5.4)
Follow-up (yr)	5.37 ± 3	4.9 ± 2.8	4.57 ± 2.7	4.52 ± 2.7*
Clinic SBP (mm Hg)	127 ± 7.5	134 ± 4.5*	148 ± 10*†	162 ± 14*†‡
Clinic DBP (mm Hg)	79.5 ± 6.5	82 ± 6*	90 ± 8*†	95 ± 11*†‡
Daytime SBP (mm Hg)	121.5 ± 7.5	139 ± 5.5*	127 ± 7*†	151 ± 12*†‡
Daytime DBP (mm Hg)	75 ± 6	83 ± 8*	77.5 ± 6*†	86.5 ± 11*†‡
Night-time SBP (mm Hg)	110 ± 11	123 ± 11*	116.5 ± 11*†	137 ± 16*†‡
Night-time DBP (mm Hg)	65.5 ± 7.5	71 ± 8*	68 ± 8*†	75.5 ± 10*†‡
24-h SBP (mm Hg)	118.5 ± 7.5	135 ± 6*	124 ± 7*†	147 ± 12*†‡
24-h DBP (mm Hg)	72.5 ± 6	80 ± 7.5*	75 ± 6*†	83.5 ± 10*†‡

BMI = body mass index; CVE = cardiovascular events; DBP = diastolic blood pressure; FHPCVD = family history of premature cardiovascular disease; LDL-C = low-density lipoprotein cholesterol; LVH = left ventricular hypertrophy; SBP = systolic blood pressure.
* $P < .05$ *v* responder hypertension; † $P < .05$ *v* masked hypertension; ‡ $P < .05$ *v* false resistant hypertension.

Framingham criteria),[23] fatal and nonfatal stroke (rapid onset of localizing neurologic deficit lasting ≥24 h with computer tomography evidence), and renal failure requiring dialysis.

Statistical Analysis

Data are expressed as mean ± SD or percentage. Groups were compared with one-way ANOVA followed by Scheffè test and χ^2 or Fisher's exact test, where appropriate.[24] Event rates are expressed as the number of events per 100 patient-years based on the ratio of the observed number of events to the total number of patient-years of exposure up to the terminating event or censor. Survival curves were estimated using the Kaplan-Meier product-limit method and compared by the Mantel (log-rank) test.[24] The effect of various covariates on survival was evaluated by using the backward stepwise Cox regression model (significance levels for inclusion and exclusion were 0.05 and 0.1, respectively).[24] Covariates included in the Cox model were: age (years), gender (men versus women), family history of premature cardiovascular disease (yes versus no), smoking habit (yes versus no), previous cardiovascular events (yes versus no), body mass index (kg/m^2), clinic BP (mm Hg) (forced into the model), low density lipoprotein (LDL) cholesterol (mg/dL), creatinine (mg/dL), diabetes (yes versus no), ambulatory BP group (responder hypertension as the reference group), and LV hypertrophy (yes versus no). Adjusted relative risks (RR) and 95% confidence intervals (CI) were calculated. Statistical significance was defined as $P < .05$. Analyses were made with the SPSS 12 software package (SPSS Inc., Chicago, IL).

Results

The main characteristics and BP of study groups are reported in Table 1. Prevalence of men was higher in the masked and true resistant groups than in the responder one. The LV hypertrophy was more prevalent in the masked than in the responder group and in the true resistant group than in the other groups. Prevalence of diabetes was higher in the true resistant group. Smoking habit tended to be more frequent in patients with masked and true resistant hypertension but did not attain statistical significance. Prevalence of heavy smokers (≥20 cigarettes/d), however, was higher in subjects with masked and true resistant hypertension than in those with responder and false resistant hypertension (15.1%, 14.6%, 7.1%, and 6.8%, respectively, $P < .05$). Creatinine was higher in patients with true resistant hypertension. Although both patients with responder and masked hypertension had clinic BP <140/90 mm Hg, and both those with false and true resistant hypertension had clinic BP ≥140 or 90 mm Hg, clinic BP was progressively higher from responder to true resistant hypertension. Ambulatory BP was significantly higher in the masked than in the responder and false resistant groups and in the true resistant group than in the other groups. It was also higher in the false resistant than in the responder group.

Coffee users were more frequent in patients with masked and true resistant hypertension than in those with

responder and false resistant hypertension (77.8%, 70%, 63.8%, and 57.5%, respectively, $P < .05$). Subjects who drank ≥3 cups/d were more frequent in the masked and true resistant groups than in the responder and false resistant ones (19%, 18.5%, 9.4%, and 9.6%, respectively, $P < .05$).

Alcohol consumption exceeded the recommended limits more frequently in subjects with true resistant hypertension that in those with false resistant, masked, and responder hypertension (20%, 8.9%, 9.5%, and 8.8%, respectively, $P < .05$); however, alcohol consumption was moderate in these subjects.

Use of anti-inflammatory drugs was more recurrent in the true resistant group than in the false resistant, masked, and responder groups (20.8%, 11%, 11.1%, and 9.1%, respectively, $P < .05$).

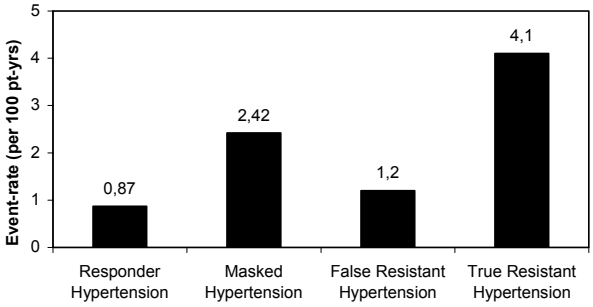
Occupational status was not significantly different among the groups. In the responder, masked, false resistant, and true resistant groups, 19.7%, 15.1%, 16.4%, and 14.6%, respectively, were housewives, 40.6%, 34.9%, 40.4%, and 39.2%, respectively, were retired persons, 32.4%, 39.7%, 39%, and 41.5%, respectively, were employees (office staff, civil servants), and 7.4%, 10.3%, 4.1%, and 4.6%, respectively, had other occupations.

Percentage of subjects receiving single, double, and multiple therapy was not different between responder and masked hypertension (58.2% *v* 62.7%, 28.2% *v* 26.2%, and 13.7% *v* 11.1%, respectively, P = not significant [NS]). Drug classes were not different. Use of three or more drugs was not different between the false and true resistant groups (85.6% *v* 89.2% and 14.4% *v* 10.8%, respectively, P = NS), and drug types were not different (about 90% in each group received a diuretic). Patients reported a good compliance to therapy.

At follow-up, in the responder and masked group clinic systolic BP was 128 ± 7 and 132 ± 4 mm Hg , respectively ($P < .05$) and clinic diastolic BP was 80 ± 6 and 80.5 ± 6 mm Hg, respectively (P = NS). Concerning apparently resistant hypertension, drug therapy was further increased in patients with true resistant hypertension, whereas fewer changes were made in those with false resistant hypertension. Adherence to nonpharmacologic therapy tended to improve. At the end of follow-up, in the false and true resistant groups clinic systolic BP was 147 ± 9 and 155 ± 11 mm Hg, respectively ($P < .05$) and clinic diastolic BP was 89 ± 8 and 91 ± 8 mm Hg, respectively (P = NS).

In the responder, masked, false resistant, and true resistant groups, 9.7%, 8.7%, 15.1%, and 18.5% of subjects, respectively, received aspirin (true resistant hypertension versus responder and masked hypertension, $P < .05$). In the same groups, 5%, 5.6%, 10.3%, and 12.3% of subjects, respectively, received statin (true and false resistant hypertension versus responder hypertension, $P < .05$).

During the follow-up (4.98 ± 2.9 years, range 0.4 to 11.6 years), 63 cardiovascular events occurred. Specifically, there were 18 myocardial infarctions (6 fatal), 8 coronary revascularizations, 8 heart failure requiring hospitalization, 23 strokes (5 fatal), 4 peripheral revascularizations, and 2 renal failure requiring dialysis.



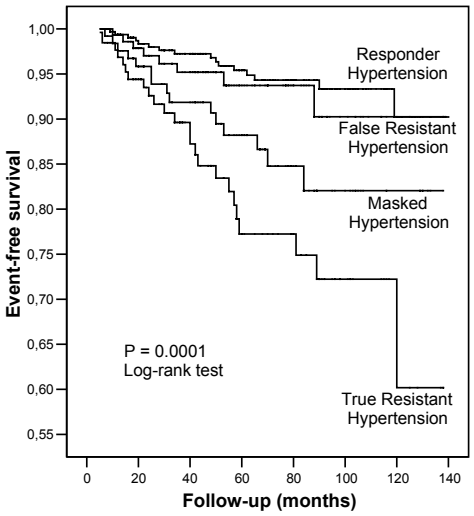


FIG. 1 Event rates per 100 patient-years (pt-yrs) (**top**) and event-free survival curves (**bottom**) in subjects with responder, masked, false resistant hypertension, and true resistant hypertension.

In the groups with responder, masked, false resistant, and true resistant hypertension, 16, 15, 8, and 24 subjects, respectively, had a cardiovascular event. In the responder group there were 6 myocardial infarctions, 3 coronary revascularizations, 1 heart failure requiring hospitalization, 5 strokes, and 1 peripheral revascularization. In the masked group there were 4 myocardial infarctions, 2 coronary revascularizations, 2 heart failure requiring hospitalization, 6 strokes, and 1 peripheral revascularization. In the false resistant group there were 2 myocardial infarctions, 1 coronary revascularization, 1 heart failure requiring hospitalization, 3 strokes, and 1 peripheral revascularization. In the true resistant group there were 6 myocardial infarctions, 2 coronary revascularizations, 4 heart failure requiring hospitalization, 9 strokes, 1 peripheral revascularization, and 2 renal failure requiring dialysis.

The event rates per 100 patient-years and event-free survival curves of study groups are reported in Fig. 1. The 95% CI of the event rate, assuming a Poisson distribution

Table 2. Independent predictors of cardiovascular events by Cox regression analysis

	RR (95% CI)	P
Age (10 yr)	1.46 (1.11–1.92)	<.01
Smoking habit (yes *v* no)	2.34 (1.33–4.10)	<.01
LDL cholesterol (1 SD)	1.45 (1.09–1.92)	<.01
Diabetes (yes *v* no)	2.66 (1.20–5.88)	<.05
LVH (yes *v* no)	2.01 (1.11–3.63)	<.05
Ambulatory BP group		
Masked *v* responder HT	2.28 (1.10–4.70)	<.05
False resistant *v* responder HT	1.22 (0.45–3.34)	.7
True resistant *v* responder HT	2.94 (1.02–8.41)	<.05
Clinic systolic BP (10 mm Hg)	1.01 (0.76–1.32)	.9

BP = blood pressure; CI = confidence interval; HT = hypertension; LDL = low-density lipoprotein; LVH = left ventricular hypertrophy; RR = relative risk.

1 SD of LDL cholesterol is 28.7 mg/dL.

of events, was 0.5–1.4, 1.36–4.0, 0.52–2.36, and 2.63–6.1, in the responder, masked, false resistant, and true resistant groups, respectively.

Backward stepwise Cox regression analysis, forcing clinic systolic BP in the model, showed that age, smoking habit, LDL cholesterol, LV hypertrophy, diabetes, masked and true resistant hypertension resulted independent predictors of events. Main results are reported in Table 2. If use of aspirin and statin and the number of antihypertensive drugs were included in the Cox model, the results did not change. When in the same Cox model false resistant hypertension was considered as the ambulatory BP reference group, cardiovascular risk was significantly higher in true resistant than in false resistant hypertension (RR 2.4, 95% CI 1.01–5.8, $P < .05$).

If clinic systolic BP or daytime systolic BP were included separately in the model as continuous variables, daytime systolic BP resulted a stronger predictor of risk. The adjusted RR associated with 10 mm Hg increment of clinic systolic BP was 1.16, 95% CI 1.0–1.36, $P = .05$, whereas the adjusted RR associated with 10 mm Hg increase of daytime systolic BP was 1.34, 95% CI 1.14–1.56, $P = .0001$. When clinic and daytime systolic BP were included in the same model, clinic BP did not attain statistical significance. Clinic diastolic BP did not result in an independent predictor of risk.

Discussion

The present study shows that, among treated hypertensive patients with apparently responder hypertension, those with masked hypertension are at higher cardiovascular risk than those with responder hypertension, and that, among patients with apparently resistant hypertension, those with false resistant hypertension are at lower risk than those with true resistant hypertension.

Clement et al[6] reported that ambulatory BP predicts cardiovascular events in treated hypertensive patients even after adjustment for clinic BP. Moreover, they divided subjects into three categories of clinic systolic BP (<140, 140 to 159, and ≥160 mm Hg) and further subdivided them in those with 24-h systolic BP <135 mm Hg and ≥135 mm Hg in each category. Among 447 patients with clinic systolic BP <140 mm Hg (apparently responder hypertension), those (71 patients) with 24-h systolic BP ≥135 mm Hg had a higher cardiovascular risk than those (376 patients) with 24-h systolic BP <135 mm Hg (adjusted RR 2.8, 95% CI 0.8–9.85).

In the study by Clement et al[6] a cut-off of 135 mm Hg for 24-h systolic BP, and not for daytime BP, was used as the normal limit for ambulatory BP. This aspect could explain the lower prevalence of masked hypertension and probably the lack of statistical significance.

Verdecchia et al[25] reported that ambulatory BP control is superior to clinic BP control in predicting cardiovascular risk in treated hypertensive patients. The risk for subsequent events was lower in patients with controlled than in those with uncontrolled ambulatory BP (RR 0.36, 95% CI 0.18–0.7, $P = .003$). Clinic BP control was not associated with a lesser risk of future events. In the study by Verdecchia et al,[25] however, subjects with controlled clinic BP and controlled or uncontrolled ambulatory BP were not analyzed separately, as in the present study.

Recently, Bobrie et al[26] evaluated the prognostic impact of clinic and home BP in elderly treated hypertensive patients. Home BP was significantly associated with cardiovascular risk, whereas clinic BP was not. More important, they reported that subjects with masked hypertension had higher risk than those with controlled hypertension (RR 2.06, 95% CI 1.22–3.47). Thus, although we and Bobrie et al[26] used different methods (ambulatory BP monitoring versus home BP) to detect masked hypertension, similar conclusions were achieved.

Globally, our results extend the present knowledge concerning masked hypertension in treated patients and add further insight into its prognostic relevance.

Redon et al[17] evaluated for the first time the prognostic importance of ambulatory BP in resistant hypertension. They studied 86 apparently resistant hypertensive patients (clinic diastolic BP >100 mm Hg) who were divided into

tertiles of daytime diastolic BP. During a mean follow-up period of 4 years, there were 2, 9, and 10 events in the lowest, middle, and highest tertile, respectively. In comparison with patients classified in the lowest tertile, the adjusted RR of cardiovascular events was 6.42, 95% CI 1.39–29.7, $P < .02$, in those classified in the highest tertile, and 3.69, 95% CI 0.79–17.33, $P = .098$, in those classified in the middle tertile. Thus, subjects with the lowest ambulatory BP had the lowest risk.

In the study by Redon et al[17], a cut-off of 100 mm Hg for clinic diastolic BP was used to define resistant hypertension, which is higher that that used in the present study, and a higher percentage of patients with previous cardiovascular events was included. These aspects can explain the lower number of subjects, the higher clinic and ambulatory BP values, and the higher risk reported. Daytime systolic BP was not used for patients' classification in that study.[17] Thus, although daytime systolic BP (132.1 ± 18.3 mm Hg) was lower in patients in the lowest tertile of daytime diastolic BP, it cannot be totally excluded that some subjects had daytime systolic BP higher than normal (>135 mm Hg). Moreover, the upper value in the lowest tertile of daytime diastolic BP was 88 mm Hg. This value is higher than that usually used to define normal daytime diastolic BP (85 mm Hg). Thus, although Redon et al[17] reported that a lower ambulatory BP was associated with a lower risk in patients with apparently resistant hypertension, they could not describe the risk profile of subjects with normal ambulatory BP. Our data confirm those by Redon et al[17] and extend the present knowledge reporting cardiovascular risk in patients with apparently resistant hypertension and normal ambulatory BP.

Various factors have been considered to explain masked hypertension.[27–30] In this study, smoking habit, coffee use, and their interaction could partly explain this phenomenon.[27–29] Moreover, a higher reactivity to daily life and work stressors might have also contributed to the higher ambulatory BP in patients with masked hypertension.[29] In addition, impaired baroreflexes related with aging could have amplified the pressor response to the aforementioned factors in some subjects.[29,30]

Time of drug administration and type of drug (and duration of action) were not different between patients with responder and masked hypertension. These aspects do not seem to explain differences in ambulatory BP, although some effect cannot be totally excluded. Concerning true resistant hypertension, various causes could be involved, such as the use of exogenous substances that increase BP or interfere with antihypertensive therapy (smoke, coffee, alcohol, anti-inflammatory drugs, sodium intake), diabetes, incomplete compliance, socioeconomic factors, mental stress, and chronic pain.[7–10] Moreover, it has also been reported that in some cases with adequate compliance it is not possible to identify a correctable cause of resistant hypertension.[7–9] In addition, rare situations such as pseudohypertension or cuff inflation hypertension[11] cannot be totally excluded in some subjects defined as having true resistant hypertension. In any case, whatever the reasons may be for masked and true resistant hypertension, this aspect does not influence our main findings.

The present study has some limitations. First, we studied only white subjects and our results cannot be applied to other ethnic groups. Second, ambulatory BP monitoring could not be repeated in all the subjects during the study.

In conclusion, this study shows that patients with masked hypertension are at higher risk than those with responder hypertension and that those with false resistant hypertension are at lower risk than those with true resistant hypertension. Ambulatory BP monitoring should be performed in patients with apparently responder and apparently resistant hypertension to obtain a better prognostic stratification.

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