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# Clinical Significance of Dipper Pattern in Hypertensive Patients

**Saturnino Suarez Ortega, Jeronimo Artiles Vizcaino, Noel Lorenzo Villalba*, Miriam Serrano Fuentes, Elena Oliva Damaso and Jose Carlos Rodriguez Perez**

*Hospital Universitario de Gran Canaria Dr Negrin, Barranco de la Ballena, s/n, Las Palmas de Gran Canaria, Las Palmas, 35000 Spain*

***Corresponding author:** Noel Lorenzo Villalba, Hospital Universitario de Gran Canaria Dr Negrin, Barranco de la Ballena, s/n, Las Palmas de Gran Canaria, Las Palmas, 35000 Spain, Tel: +34697271986; E-mail: noellorenzo@gmail.com

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## Abstract

Ambulatory blood pressure monitoring (ABPM) is a suitable method for studying the vascular risk and the degree of hypertension control. The objective of this work focuses on the dipper pattern, comparing the prevalence and characteristics with other circadian patterns in hypertensive patients. ABPM was performed in 1320 hypertensive patients. We selected those who met the requirements of "valid" according to the CardioRisc protocol (1126, 85.3%). Dipper pattern was defined when the average blood pressure (BP) at rest was between 10% and 20% below the average of the activity BP. We have considered as low vascular risk those from light to moderate levels, and the rest as high vascular risk. Controlled BP was considered when the office BP was less than 140/90 mmHg. The distribution of the patterns was as follows: dipper (476, 42.3%), non-dipper (448, 39.8%), riser (140, 12.4%) and extreme dipper (62, 5.6%). The mean age was 52.96 ± 15.37 years. 53.8% of the 476 hypertensive dipper were women, of which 25% were taking 3 or more drugs, compared with 38.7% of non-dipper (this group needed less medication to achieve an adequate control). The degree of control (51.9% vs. 45%) and vascular risk was better in patients with dipper pattern. A statistically significant difference between the average pulse pressure (PP) for the riser pattern in both the office PP (59.76 ± 16) and the 24 hours ABPM PP (58.7 ± 15.7) was observed. Hyperlipidemia was the vascular risk factor most frequently associated.

**Keywords:** Hypertension; ABPM; Dipper; CardioRisc

## Background

Several studies have defined the complementarity of ambulatory blood pressure monitoring (ABPM) with the office blood pressure (BP) [1,2]. The additional value of the ABPM, with its drawbacks, is maximum, since it is the only technique that allows us to analyze the rest period. The lack of nocturnal fall in BP is a well-established cause of vascular risk [3,4]. We perform the assessment of nocturnal BP with ambulatory monitoring using a device called Holter. With the different measures of BP obtained with this apparatus (an average of 64 per day, considering every 20 minutes during the day and every 30 minutes at night) graphics are obtained, which allow us to identify 4 patterns by comparing the average BP during the activity period versus the rest period. In the normal or dipper pattern the mean BP (MBP) at rest is between 10 and 20% lower than in the activity period; in the extreme dipper pattern the MBP in the rest period is 20% lower than the MBP of the activity period; in the non-dipper the MBP during rest is between 0 and 10% lower than the MBP during activity; and finally, in the riser pattern the MBP at rest is higher than the MBP during the activity period [5]. However the ABPM has still low representation in hypertension guidelines [6,7]. Studies of hypertension (HBP) and circadian rhythm have focused on the study of the riser pattern or comparing the four circadian patterns. There rarely is a specific analysis of dipper pattern [8,9], although it has been recently shown that the change of a non-dipper to a dipper pattern improves cardiovascular risk [10]. The objective of this work focuses on the dipper pattern comparing the prevalence and characteristics of the dipper pattern with other circadian patterns in hypertensive patients. We analyze particular aspects of this pattern and other patterns of circadian rhythm referenced in the literature and observed by us.

## Patients and Methods

A 10 years analysis of all ABPM performed using Cardiorisc project in hypertensive patients was conducted. The sample represents the ABPM of the hypertensive patients evaluated using this project. First ABPM evaluation or those difficult to be controlled (without BP targets achieved with at least 3 drugs) were included. Those who did not provide at least the minimum number of BP determinations including at activity and rest were excluded according to the basis of this protocol. A total of 1126 hypertensive patients with these features were enrolled. The CardioRisc project [11], driven by the Spanish Society of Hypertension and sponsored by Laboratories Lacer, has achieved the most important database of ABPM until now. Cardiorisc project allows classifying patients in 5 levels: normal, low, moderate, high and very high according to the current European Guidelines for the diagnoses; treatment and management of hypertension. We classified and grouped patients at normal, low and moderate as at low risk and the rest were considered at high risk; so the initial variable was recoded to dichotomous.

Demographic variables, distribution of classic patterns and characteristics of the dipper pattern in comparison with other circadian patterns were analyzed. Patients were divided in two groups according to the pattern (dipper against the non-dipper pattern) and these groups compared. The average values of pulse pressure (PP) during activity, rest and 24 hour period were compared with the PP obtained from the average values of the office BP. We established the hypothesis that the value of the average PP remains stable in hypertensive patients with a healthy vascular tree, regardless of changes that occur along the circadian rhythm in BP variability. Descriptive statistical analysis and contrast test of equality of means for two related samples using SPSS15 statistical program was applied.

## Results

In a total of 1126 cases; the distribution of patterns was as follows: dipper (476, 42.3%), non-dipper (448, 39.8%), riser (140, 12.4%) and extreme dipper (62, 5.6%). The mean age was 52.96 ± 15.37 years (range: 14-90 years), with 50.1 years in the dipper hypertensive (HT-D) versus 55.01 in the rest (HT-ND), showing statistically significant differences comparing the other 3 groups (dipper, non-dipper and dipper extreme) with the riser pattern (61.7 versus 51.7 years). In this respect; mean age in dipper pattern was 50.1 years in dipper 52.1 in non-dipper; 61.06 in extreme dipper and 61.7 years in riser.

Women represented 51.9% (585) of the sample, 256 (22.7%) in the dipper group, 225 (20%) in non-dipper, 39 (3.5%) in extreme dipper and 65 (5.7%) in the riser group. 256 (53.8%) of the 476 HT-D and 329 (50.6%) of the 650 HT-ND were women.

119 HT-D (25%) versus HT-ND 252 (38.7%) were taking 3 or more drugs; 247 (51.9%) HT-D versus 294 (45%) HT-ND were controlled. There were 113 HT-D (23.7%) versus 258 HT-ND (39.7%) with high cardiovascular risk. The distribution of patients taking 3 or more drugs according to the pattern was: 25% dipper pattern, 33.9% no dipper, 35% extreme dipper and 54.8% riser. Taking into consideration the Ten rule (one hypertensive drug taking at full dose is able to reduce blood pressure by 10 mmHg) and that what is important is certainly the blood pressure control to reduce vascular risk, the type of antihypertensive drug taking was not evaluated but the number of them. In the sample studied, 48.4% of patients achieved a good blood pressure control (BP<140/90) and the distribution by groups was: 51.9% dipper group, 48.2% no-dipper, 41.9% extreme dipper, 35.7% in the riser group.

Mean pulse pressure of the sample at consultation was 55.42 mmHg, 53.48 mmHg in the dipper group, in non-dipper group, 56.31 mmHg in the extreme dipper group patrón dipper extreme and 59.76 mmHg in the riser group. 51.24 mmHg was the mean value of pulse pressure during 24 hours ABPM and the behaviour by groups was: 48.20 mmHg in the dipper group, 51.68 mmHg in no dipper, 50.50 mmHg in the extreme dipper, 58.7 mmHg in the riser group.

The average pulse pressure (PP) in HT-D versus HT-ND was: office PP (53 ± 12 versus 58.2 ± 13), and the average of PP in ABPM (48.85 ± 18 versus 53 ± 12.4), being both values statistically significant. The difference was even more patent for the riser pattern in both the office PP (59.76 ± 16) as of ABPM PP (58.7 ± 15.7). Comparison of mean values for the number of drugs, degree of control and cardiovascular risk was statistically significant for the dipper pattern versus non-dipper, needing fewer drugs to control blood pressure, achieving a greater degree of BP and less vascular risk. The prevalence of hyperlipidemia was 48.7% and prevalence of diabetes was 19.4%, showing the high prevalence of these two vascular risk factors in hypertensive patients. Hyperlipidemia was present in 48.7% of patients (754) and the distribution by groups was 41.6% of dipper, 45.7% of no dipper, 50% of extreme dipper, 80% of riser. Diabetes was present in 10.8 % of dipper, 16.8% of no dipper, 30% of extreme dipper, 52% of riser.

## Discussion

Previous studies show that in hypertensive patients the dipper pattern has lower cardiovascular risk compared to the other three patterns of ABPM. The riser pattern, compared with the rest three patterns, has greater PP and worse vascular risk [12,13]. Recently and concurring with the economic crisis, we have noticed an increased prevalence of a hypertension model, that is working pressure, which behaves as masked hypertension in activity and shows very marked dipper pattern [14].

The value of vascular risk in this subgroup has not been previously studied. Depending on the number of hours at work (pattern A: 7 hours or pattern B: 12 hours) so it will be the vascular risk in both subgroups.

The value of the PP as a guiding method for appropriate office BP value had not been reported, although it is habitual in the ABPM that systolic and diastolic BP follow a parallel line when there is an appropriate response of the blood vessel wall, a circumstance that disappears with atherosclerotic disease. We have named this morphological situation "parallelism", suggesting that the value of the PP remains constant within the BP variability over 24 hours when there are healthy arteries [15,16]. This is visible both on the ABPM and on the BP self-measurement at home. When this situation does not occur the PP is usually higher reflecting a state of altered vascular wall and is associated with an increased expression of target organ damage [17]. Aspects such as the degree of control with ABPM, which eliminates the white coat effect in office BP, increase the degree of control around 10%. This modifies the degree of control in comparison with the office BP [18], but at a level not as marked as most other studies correlating ABPM with office BP. Along with the white coat effect the presence of masked hypertension is also notorious, a peculiar aspect of the ABPM, which detects apparently controlled hypertension by office BP, reflecting at the same time the high risk of this subgroup of hypertensive patients detected only by ABPM [19]. The value of the riser pattern as an indicator of vascular risk and probably as a result of prolonged action on the vessels of vascular risk factors, has been analyzed in many studies and is confirmed by the data from this sample.

There is no scientific evidence to corroborate the use of antihypertensive drugs at bed time in the presence of masked hypertension (no dipper and riser patterns). The fact that riser pattern is mostly seen in diabetic patients could be due to both failure of the autonomic system to regulate blood pressure and wall vessel damage which loses elasticity and is not able to adequate respond to neurohormonal mechanisms.

## Conclusion

1. The distribution of the classic patterns of ABPM in this study are similar to those published by the CardioRisc project.

2. The degree of control in hypertensive patients analyze is higher compared to office BP control

3. The control of BP is worse in hypertensive patients requiring more drugs.

4. Hypertensive patients presenting with riser pattern have a very high vascular risk and those with the dipper pattern have lower cardiovascular risk.

5. The ABPM is a suitable method to clarify the diagnosis of hypertension in borderline cases and define the chronotherapy in hypertensive patients.

## References

1. Harianto H, Valente M, Hoetomo S, Anpalahan M (2014) The clinical utility of ambulatory blood pressure monitoring (ABPM): a review. Curr Hypertens Rev 10: 189-204.
2. Segura J, Banegas JR, Ruilope LM (2014) Usefulness of ambulatory blood pressure monitoring (ABPM) in daily clinical practice: Data from the Spanish ABPM registry. Clin Exp Pharmacol Physiol 41: 30-36.
3. Kikuya M, Hozawa A, Okokubo T (2000) Prognostic significance of blood pressure and heart rate variabilities: the Ohasama study. Hypertension 36: 901-906.
4. De la Sierra A, Gorostidi M, Sobrino J, García León M, Comerma J, et al. (2008) Prevalence of a riser pattern of nocturnal blood pressure in patients with hypertension. The Spanish society of Hypertension ABPM registry. 18th Scientific meeting of the European Society of Hypertension. Berlín. J Hypertens (Suppl 1): S503.
5. Mancia G, Parati G, Omboni S, Ulian L, Zanchetti A (1999) Ambulatory blood pressure monitoring. Clin Exp Hypertens 21: 703-715.
6. Mancia G, Fagard R, Narkiewicz K, Redón J, Zanchetti A (2013) The Task Force for the management of arterial hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). 2013 ESH/ESC Guidelines for the management of arterial hypertension. J Hypertens 31: 1281-1357.
7. Hermida RC, Smolensky MH, Ayala DE, Portaluppi F, Crespo JC, et al. (2013) Recomendaciones 2013 para el uso de la monitorización ambulatoria de la presión arterial para el diagnóstico de hipertensión en adultos, valoración de riesgo cardiovascular y obtención de objetivos terapéuticos (resumen). Recomendaciones conjuntas de la ISC, AAMCC, SECAC, SEA y RSIM. Clin Invest Arterioscl 25: 74-82.
8. Sarlak H, Arslan E, Demirbas S, Cakar M, Bulucu F, et al. (2015) Dipping status in individuals monitored by ambulatory blood pressure measurements. Journal of the American Society of Hypertension 9: e35–e48.
9. O'Brien E (2009) Dipping comes of age. The importance of nocturnal blood pressure. Hypertension 53: 446–447.
10. Sousa F, Neves J, Ferreira R, Polonia J, Bastos JM (2015) In hypertension the change from a non-dipper to a dipper pattern is associated with a better cardiovascular prognosis than the persistence within the non-dipper pattern. J Hypertens 33: e6.
11. https://www.cardiorisc.com/CR/index.asp.
12. Suárez Ortega S, Godoy Díaz D, Artiles Vizcaíno J, Rodríguez Pérez JC, Prieto Vicente A, et al. (2009) Aportaciones de la monitorización ambulatoria a los valores de la Presión arterial casual. Rev Med Inst Mex Seguro Soc 47: 621-626.
13. De la Sierra A, Segura J, Banegas JR, Gorostidi M, de la Cruz JJ, et al. (2011) Clinical features of 8295 patients with resistant hypertension classified on the basis of ambulatory blood pressure monitoring. Hypertension. 57: 898-902.
14. Suárez Ortega S, Merlán Hermida A, Salas Reinosa L, Artiles Vizcaíno J, Afonso Déniz J, et al. (2014) Hipertensión vinculada al estrés laboral. 19ª Reunión Nacional Sociedad Española de Hipertensión-Liga Española para la Lucha contra la Hipertensión Arterial. Hipertension. Suppl. Especial congreso 31: 42-43.
15. Muntner P, Whittle J, Lynch AI, Colantonio LD, Simpson LM, et al. Visit-to-visit variability of blood pressure and coronary heart disease, stroke, heart failure, and mortality: a cohort study. Ann Intern Med 163: 329-338.
16. Suárez Ortega S, Godoy Díaz D, Prieto Vicente A, Artiles Vizcaíno J, Rodríguez Hernández J, et al. (2008) Utilidad de la presión de pulso por monitorización ambulatoria de la presión arterial como método orientador de la adecuada toma de presión arterial casual. Hipertensión 25.
17. Palmas W, Pickering T, Eimicke JP, Moran A, Teresi J, et al. (2007) Value of ambulatory arterial stiffness index and 24-h pulse pressure to predict progression of albuminuria in elderly people with diabetes mellitus. Am J Hypertens 20: 493-500.
18. Pickering TG, Shimbo D, Haas D (2006) Ambulatory blood-pressure monitoring. N Engl J Med 354: 2368-2374.
19. Tomiyama M, Horio T, Yoshii M, Takiuchi S, Kamide K, et al. (2006) Masked hypertension and target organ damage in treated hypertensive patients. Am J Hypertens 19: 880-886.