

Ambulatory Blood Pressure Monitoring in Chronic Congestive Heart Failure in Normotensive and in Sinus Rhythm Patients with Ischemic Heart Disease

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Objectives: The objective of this study is to analyse the blood pressure behaviour, before and after compensation by medical treatment of decompensated chronic congestive heart failure, in normotensive and in sinus rhythm patients with ischemic heart disease. Its main purpose is to find out whether heart failure compensation is associated with still normal blood pressures or, on the contrary, with the risk of an arterial hypotension.

Methods: Data recorded by 24 hours ambulatory blood pressure monitoring, before and after an efficient compensation of heart failure in 16 patients (13 males and 3 females) with decompensated chronic congestive heart disease secondary to ischemic heart disease in functional NYHA classes III (5 patients) or IV (11 patients) were analysed and compared.

Results: In the decompensated state, mean systolic blood pressure per 24 h was normal, but well below the superior limit accepted as normal. Significant decreases of all systolic and diastolic blood pressures, per 24 h, diurnal and nocturnal, close to or even in the domain of arterial hypotension, were recorded after the efficient compensatory treatment. None of the patients had clinical symptoms of arterial hypotension. Significant prevalence of the non-dipper state, high in the decompensated state and still present after the efficient heart failure compensation, was found. A significant decrease of the heart rate after heart failure compensation was observed. Decompensated state was associated mainly with heart rates above 70/min, while the compensated state was associated mainly with heart rates below 70/min.

Conclusions: Significant asymptomatic decrease of the blood pressure, with a tendency towards arterial hypotension, is revealed by ambulatory blood pressure monitoring, after the efficient treatment of the decompensated chronic congestive heart failure, in normotensive and in sinus rhythm patients with ischemic heart disease. This blood pressure decrease could add a supplementary cardiovascular risk. A high prevalence of the non-dipper state, with its negative significance, was found especially in the decompensated, but also in the compensated state of the chronic congestive heart failure.

Keywords: ambulatory blood pressure monitoring, blood pressure decrease, decompensated chronic congestive heart failure, ischemic heart disease with sinus rhythm, non-dipper

Introduction

Blood pressure variations may be both consequences and precipitating factors of chronic congestive heart failure, with prognostic implications. Ambulatory blood pressure monitoring in patients with chronic congestive heart failure can offer useful data regarding the clinical state [1], evolution during different drug treatments and prognosis [2–7].

The present study makes an analysis of data obtained by ambulatory blood pressure monitoring in normotensive and in sinus rhythm ischemic heart disease patients, before and after an efficient medical treatment of decompensated chronic congestive heart failure. The main objective is to find if a correct and clinically beneficial treatment of the chronic congestive heart failure decompensation, in normotensive and sinus rhythm ischemic heart disease patients, is associated with still normal blood pressures or, on the contrary, the risk of an arterial hypotension, with its potential consequences, exists.

Material and methods

Ambulatory blood pressure monitoring was performed in 16 normotensive, in sinus rhythm patients (13 males and 3 females) with decompensated chronic congestive heart failure secondary to ischemic heart disease, in functional NYHA classes III (5 patients) or IV (11 patients). All of the patients had a previous chronic congestive heart failure history.

Ischemic etiology of the cardiopathy was proved by a myocardial infarction history (in 7 patients) or by symptomatic myocardial ischaemic changes, with angina pectoris associated with electrocardiographic ischaemic changes and/or echocardiographic ventricular wall segmental kinetics alterations.

The risk profile of the patients comprised: dyslipidemia in 9 patients, obesity in 2 patients, diabetes mellitus in 2 patients, smoking in 7 patients, cardiovascular familial history in 11 patients.

Standard treatment for the compensation of chronic congestive heart failure comprised: angiotensin converting enzyme inhibitors (16 patients), furosemide (16 patients), spironolactone (16 patients), betablockers (13 patients), digoxin (8 patients), nitrates (2 patients).

The first ambulatory blood pressure recording was started in the first morning of the hospital admission (at 9h), in a decompensated moment of the chronic congestive heart failure. The second recording was started in the morning (at 9h) of the last day of the hospital stay, in a compensated state of the chronic congestive heart failure.

A MEDITECH device was used for the 24 hour ambulatory blood pressure monitoring. The following data were supplied: mean 24 h systolic blood pressure, mean diurnal systolic blood pressure, mean nocturnal systolic blood pressure, mean 24 h diastolic blood pressure, mean

Table I. Ambulatory blood pressure monitoring in patients with chronic congestive heart failure secondary to ischemic heart disease, in the decompensated state and after compensation by an efficient medical treatment

Parameter	Decompensated chronic congestive heart failure	Compensated chronic congestive heart failure	p
Mean SBP/24h (mmHg)	111.3±8	100.8±8.2	<0.001
Diurnal mean SBP (mmHg)	112.2±8.7	102.1±9	<0.001
Nocturnal mean SBP (mmHg)	109.2±7.3	97.6±8.3	<0.001
Mean DBP / 24 h (mmHg)	69.3±3.7	61±5.8	<0.001
Diurnal mean DBP (mmHg)	70±4.3	63.3±6.7	0.001
Nocturnal mean DBP (mmHg)	67.6±4.3	58.3±5	<0.001
PP / 24 h (mmHg)	41.6±8.4	38.4±8.4	0.02
Diurnal PP (mmHg)	41.68.6	38.3±8.8	0.03
Nocturnal PP (mmHg)	41.3±8.6	38.5±8.3	0.05
Dipper/Non-dipper (no. of patients)	2/14	6/10	0.04
Mean HR /24h (b/min)	72.4±12.3	64.7±12.7	<0.001
Diurnal mean HR (b/min)	74.9±12.4	66.7±13.4	<0.001
Nocturnal mean HR (b/min)	68.3±12.8	61.7±12.2	0.001
PTE/24h	4.25±4.8	0.3±0.8	0.006
Diurnal PTE (%)	2.5±3.2	0.1±0.5	0.01
Nocturnal PTE (%)	5.8±7.5	0.8±2.4	0.01
Load / 24 h	3.1±4.2	0.06±0.2	0.01
Diurnal load (mmHg x hours)	2.3±3.3	0.06±0.2	0.01
Nocturnal load (mmHg x hour)	3.8±5.3	0.2±0.7	0.01
MBP / 24 h (mmHg)	84.1±3.4	74.1±4.3	<0.001
Diurnal MBP (mmHg)	85±3.7	76±5.8	<0.001
Nocturnal MBP (mmHg)	82.1±4.1	71.1±4.4	<0.001
Mean of MaxSBP / 24 h (mmHg)	135.5±9.5	123.8±11.8	<0.001
Diurnal mean of MaxSBP (mmHg)	135±10	123.5±12.4	<0.001
Nocturnal mean of MaxSBP (mmHg)	135.2±8	111.9±9.9	<0.001
Mean of MinSBP / 24 h (mmHg)	90.8±11.5	79.6±7.1	0.001
Diurnal MinSBP (mmHg)	91.5±10.7	81±8.2	0.003
Nocturnal MinSBP (mmHg)	94.3±11.2	84.3±7.7	<0.001
Mean of MaxDBP / 24 h (mmHg)	85.4±5.7	78.4±6.1	<0.001
Diurnal MaxDBP (mmHg)	85.5±5.9	77.6±6.7	<0.001
Nocturnal MaxDBP (mmHg)	79.8±5	71.5±7	0.01
Mean of MinDBP / 24 h (mmHg)	51.5±6.5	44.9±4.8	0.005
Diurnal MinDBP (mmHg)	52.8±7.2	46.8±6.9	0.003
Nocturnal MinDBP (mmHg)	54.3±4.3	47.8±4.7	0.001

Abbreviations: HR – heart rate, SBP – systolic blood pressure, DBP – diastolic blood pressure, PTE – percent time elevation, MBP – mean blood pressure, MaxSBP – the highest individual systolic blood pressure, MinSBP – the lowest individual systolic blood pressure, MaxDBP – the highest individual diastolic blood pressure, MinDBP – the lowest individual diastolic blood pressure

diurnal diastolic blood pressure, mean nocturnal diastolic blood pressure (all in mmHg), 24 h, diurnal and nocturnal pulse pressure (mmHg), diurnal index (% day/night blood pressure variation), mean 24 h, diurnal and nocturnal heart rate (b/min), 24 h, diurnal and nocturnal percent time elevation, 24 h, diurnal and nocturnal load (mmHg), 24 h, diurnal and nocturnal mean arterial blood pressure, maximum and minimum 24/h, diurnal and nocturnal individual systolic and diastolic blood pressure. Percent time elevation (% of 24 h) indicates the time spent with blood pressure exceeding normal values (130/80 mmHg in 24h, 135/85 during the vigil state and 120/80 mmHg during the sleep). Load is the hyperbaric impact, expressed in mmHg × hours. The load and the percent time elevation indicate the hypertensive load of the patient. Diurnal index (the day/night mean blood pressure rate) indicates the state of dipper (a lowering of

at least 10% of the nocturnal mean blood pressure) or non-dipper (lack of this lowering) of the patient. Data obtained by the two recordings were compared by the Student test.

Results

Medical treatment of the decompensation resulted in the clinical compensation of the chronic congestive heart failure, in all of the observed patients.

Results of the ambulatory blood monitoring in the observed patients are presented in Table I.

Discussion

Patients were normotensive at their first ambulatory blood pressure recording. Nevertheless, it is to be noted that mean systolic blood pressure / 24 h recorded by ambulatory blood pressure monitoring (slightly above 110 mmHg) was well below the superior value accepted as normal.

Highly significant decreases of all systolic and diastolic blood pressures were recorded by ambulatory blood pressure monitoring after the efficient compensatory treatment of chronic congestive heart failure.

A highly significant decrease of mean systolic blood pressure (of more than 10 mmHg) occurs. The decrease of the mean values of systolic blood pressure is both diurnal and nocturnal. Systolic blood pressure /24 h falls from 111.3±8, to 100.8±8.2 mmHg. The lowest values of 24 h systolic blood pressure are situated around 80 mmHg.

After the compensation of chronic congestive heart failure, very significant decreases of the mean diastolic blood pressure (about 8 mmHg/24h, 7 mmHg during the day and 9 mmHg during the night) occur. The difference between diurnal and nocturnal mean diastolic blood pressure reaches 5 mmHg. Substantial falls of the lowest values of diastolic blood pressure also occur.

It should be emphasized that, despite of the significant lowering of the blood pressure recorded by ambulatory blood pressure monitoring, none of the patients had symptoms of arterial hypotension.

Hydrosaline depletion, as well other hypotensive actions of the drugs contributed to this important decrease of the blood pressure [2–5]. Impaired left ventricular function is also to be considered.

Systolic blood pressures after the compensation of the chronic congestive heart failure in the observed patients with ischemic heart disease in sinus rhythm are situated in a high risk area. Even if asymptomatic in our patients, systolic blood pressures of 80±8 mmHg and minimum individual diastolic blood pressures of 45±5 mmHg, recorded after the compensation of the heart failure could be associated with a potential risk.

In a study of ambulatory blood pressure monitoring during the evolution of patients with heart failure, Cane-sin et al [3,4] found that mean blood pressure/24 h and at wake, and systolic blood pressure during sleep were higher in survivors, than in the deceased patients, and were sig-

nificant in predicting the survival duration. Patients with systolic blood pressure per 24 h ≥ 105 mmHg, during the vigil period and during sleep, had a significantly longer survival. The same observation was done for mean systolic blood pressures of ≥ 80 mmHg. In a multivariate analysis, these authors found that patients with systolic nocturnal blood pressures below 105 mmHg had a 7.6 times higher death probability, than those with systolic blood pressures ≥ 105 mmHg.

Mak et al [5] found, by ambulatory blood pressure monitoring, in the heart failure, an increase of arterial hypotension episodes during the titration of drugs with hypotensive activity (angiotensin converting enzyme inhibitors, blockers of the angiotensin II receptors, beta-blockers), that were not found by the usual blood pressure recordings. Neuromodulator agents may increase the "hypotensive load", despite of apparently secure blood pressure levels, recorded in the clinical practice way. Patients with the most episodes of arterial hypotension had more hospital readmissions and a higher occurrence of a composite endpoint of all cause mortality/hospital readmissions. "Hypotensive load" is considered an independent predictor of these endpoints.

An only minimal hypertensive load per 24 hours in the decompensated heart failure followed by a supplementary decrease in the compensated moment is observed in the present study.

High prevalence of the non-dipper state, very important in the decompensated state and only partially corrected after the efficient heart failure compensation, was found in the observed patients. This observation confirms the prevalence of the non-dipper state, with its deleterious significance, in the congestive heart failure [6,7].

A significant decrease of the heart rate after the heart failure compensation in patients with ischemic heart disease in sinus rhythm was found. Decompensated state was associated mainly with heart rates above 70/min, while the

compensated state was associated with heart rates below 70 min.

Conclusions

1. Significant asymptomatic decrease of the blood pressure, with a tendency towards arterial hypotension, revealed by ambulatory blood pressure monitoring, occurs after the compensation by an efficient medical treatment of decompensated chronic congestive heart failure, in normotensive and in sinus rhythm patients with ischemic heart disease; it could add a supplementary cardiovascular risk.
2. High prevalence of the non-dipper state, very important in the decompensated state and only partially corrected after the efficient heart failure compensation, was found in chronic congestive heart failure secondary to ischemic heart disease, normotensive and in sinus rhythm patients.

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