

Is Diastolic Pressure Losing its Clinical Usefulness?

Rafael Leite Luna and Leonardo Castro Luna

Instituto de Pós-Graduação Médica Carlos Chagas, Hospital das Clínicas de Jacarepaguá - Rio de Janeiro, RJ - Brazil

Medical science is constantly evolving, and new studies and research frequently show facts that challenge old dogmas; currently, this is the case with diastolic arterial pressure.

Traditionally, arterial hypertension is divided into two main clinical categories: isolated systolic hypertension, which is more common and an attribute of age, and combined systolic and diastolic hypertension, which is less common¹. Lately, a series of studies has questioned the clinical usefulness of diastolic pressure, as we will see below.

Those of us from a previous generation remember that whenever we read the outcome of a therapeutic trial, we knew that it was always based on diastolic results; the same was true when we evaluated the results of an antihypertensive treatment.

During the last century, physicians had the tendency to estimate diastolic pressure elevation as being more important than the systolic value, based on the belief that it had a better correlation with target-organ damage; currently this point of view lacks confirmation.

In 1920, when blood pressure started to be measured frequently, the diastolic component was considered more important, and although this preference has never been duly justified, it prevailed for a good part of the 20th century.

This was the standard for each assay or clinical study, from the first to the last, up to the Systolic Hypertension in the Elderly Program (SHEP), in 1991².

According to Safar, in assays evaluating the benefits of antihypertensive treatment, diastolic pressure was chosen as the only criterion for inclusion of patients. Consequently, if the systolic pressure was elevated and the diastolic pressure was normal, subjects were excluded from the assessments and were, therefore, not analyzed³. This flaw in planning introduced an assessment error not only in patient selection, but also at the end of clinical follow-up, since diastolic pressure could be normalized but the systolic pressure was not appreciated.

This fact became very clear in the HOT [Hypertension Optimal Treatment] Study that analyzed middle-aged patients with combined systolic and diastolic hypertension. At the end of the study, despite a rigorous control of the diastolic pressure, a poor result in the medication was noted in terms

of cardiovascular risk, and the reason was attributed to a lack of systolic pressure control, which incidentally, was not the objective of the trial⁴.

During the 1950s, according to Kaplan, insurance companies had already begun to pay attention to the fact that elevated systolic levels represented a cardiovascular health risk, but this was not taken into consideration⁵.

In 1971, a publication of the Framingham Study documented, for the first time and with the full weight of its authority, the great predictive value of systolic pressure for cardiovascular disease. The data from this study, based on the 30-year evolution of a cohort, associated the degree of cardiovascular disease development with systolic pressure for all ages and in both genders⁵.

In fact, since the original studies of arterial pressure, in the first half of the previous century, there were signs of the importance of the systolic measurement; it was not well understood why its value was not properly recognized⁶.

On the other hand, influenced by the abovementioned studies, in 1990 the National High Blood Pressure Education Program of the United States recommended that systolic pressure be ascribed a more important role in the diagnosis and treatment of arterial hypertension⁷.

Today, it is known that isolated systolic hypertension is present in two-thirds of patients aged over 60 years. It is the age group that currently also includes, according to Staessen et al., the majority of hypertensive individuals⁸.

One of the problems in evaluating systolic pressure in elderly patients is its drop in left ventricular dysfunction, making it difficult to define its true level, although there is always an evident hypertensive antecedent in the patient's medical history.

In 1995, the famous epidemiological survey, NHANES III, performed in the USA, showed fundamental and vitally important data demonstrating that systolic and diastolic pressures undergo a normal and continuous increase during life up to 50 years of age in most individuals. From then on, the systolic pressure continues to increase, but the diastolic pressure generally shows a tendency to fall⁹. Asmar et al., consider these changes a result of increased rigidity of the aorta and large arteries, and they are possibly correct¹⁰.

Today, systolic pressure is recognized as the best predictor of cardiovascular risk after 50 years of age¹¹. Corroborating this fact, the large Prospective Studies Collaboration trial showed that between the ages of 40 and 90 years, systolic pressure is more predictive than diastolic pressure of the risk of death in ischemic heart disease¹².

As mentioned above, over the last quarter of century, several epidemiological studies have valued systolic pressure

Key words

Blood pressure/thic; hypertension; follow-up studies.

Mailing address: Rafael Leite Luna •

Praia do Flamengo, 374/501 - Flamengo - 22210-030 - Rio de Janeiro, RJ - Brazil

E-mail: rluna@cardiol.br

Manuscript received March 2, 2007; revised manuscript received March 25, 2007; accepted May 9, 2007.

as the most important parameter for cardiovascular risk, primarily in elderly people. Nevertheless, it was only during the 1990s that a change in medical mentality occurred, starting to emphasize systolic pressure over diastolic pressure, both in the diagnosis and in the classification and management of arterial pressure.

In persons under 45 years of age, isolated systolic hypertension is rare, but at this age, isolated elevated diastolic pressures with normal systolic pressures may appear, although in a minority, as displayed in Table 1.

Table 1 - Percentage of Cases with Isolated Diastolic Hypertension

National Health Examination Survey (NHES)	6%
National Health and Nutrition Examination Survey (NHANES)	9%
Fang e cols. (Hypertension 1995; 26: 377)	16%
Strandberg e cols. (J Hypertens 2002; 20: 399)	10%

One of the reasons alleged in the past century for the clinical importance given to the diastolic parameter was that during the diastolic period, arteries would be exposed to pressure for a longer time than during the systolic period. However we point out the fact that during diastole, the transmural pressure progressively falls until the beginning of systole. Another reason claimed in the past, from the clinical point of view, was that coronary circulation, during the diastole, was more influenced by the pressure level during this period and was important, therefore, for determining the integrity of the coronary arteries.

Again, we should bear in mind that during diastole, there is a continuous drop in arterial pressure. It is possible that the diastolic measurement is not the most important factor for explaining coronary artery disease, but that there are other factors involved, such as endothelial function, lipid levels, or thrombophilia, and tension levels need to be adjusted in order for their value to be appreciated.

We know that a rise in systolic pressure depends on increased systolic output, increased peripheral resistance, or rigidity of the large arteries.

From a pathophysiological point of view diastolic pressure has not yet been specifically studied. It is known that it increases with the rise in peripheral resistance but unlike the systolic it decreases with the rigidity of large arteries. Theoretically, then, diastolic pressure can be normal, since the effects exerted by peripheral resistance and by aortic rigidity can mutually annul each other, although these changes are, *per se*, risk factors.

To our surprise, at the end of the last century, scientific studies appeared challenging the deep-rooted idea established over the previous one-hundred years that elevated diastolic pressure represented the same cardiovascular risk as systolic hypertension. These papers contradicted the prevailing medical opinion of the time that resulted from many years of questionable medical assessments.

In 1995, Alderman and his group, in New York published the first article informing that young and middle-aged (<60 years) patients whose cardiovascular disorder was elevated diastolic pressure, presented a better prognosis than those with elevated systolic and diastolic pressures combined, with a higher risk for myocardial infarction. Additionally, when patients with isolated diastolic hypertension were stratified according to systolic pressure levels, i.e., above and under 140 mmHg, myocardial infarction only happened with systolic pressures above 140 mmHg, regardless of the diastolic level (90 to 115 mmHg). In addition, even if the patients presented levels of cholesterol and glucose, number of cigarettes, and genders adjusted for a multivariate analysis, the association with infarction only appeared in the presence of combined systolic and diastolic hypertension, and not with isolated diastolic hypertension¹³.

In 2000, a group in Japan headed by Hozawa et al., in a study with 1913 patients 40 years of age or over, who were followed for more than eight years, showed that isolated diastolic hypertension offers a low risk for cardiovascular mortality, similar to that of individuals with normal pressures. This suggests that the prognosis of hypertension should be based on the systolic and not on the diastolic level¹⁴.

In 2001, Benetos et al.¹⁵, in Paris, carried out a large study with 77023 men and 48480 women on the risks offered by systolic and diastolic hypertension. This study produced some interesting conclusions, as follows: 1. In men and women with normal systolic pressure (<140 mmHg), diastolic pressure was not a determinant of cardiovascular mortality, even after being adjusted for age and systolic pressure level; 2. The highest mortality rates were noted in men with isolated systolic hypertension; 3. In women with isolated systolic hypertension, there was also an elevated mortality rate that increased if the diastolic pressure was also high¹⁵.

Strandberg et al.¹⁶, in 2002, studying a cohort of 342 patients with isolated diastolic hypertension observed for 32 years, found no increase in cardiovascular mortality as long as there was no combined elevation of diastolic and systolic pressures. In this case, cardiovascular mortality increased 2.7 fold, clearly showing that the risk only appeared when systolic levels were also elevated¹⁶.

Likewise, Pickering found no increased cardiovascular risk in isolated diastolic pressure elevation, and assertively stated: "There is absolutely no indication, at present, for treating isolated diastolic hypertension"¹⁷.

As systolic pressure grew in importance, a large number of studies on pulse pressure and its prognostic value began to appear, especially in Framingham's group, that has just published a brilliant paper correlating atrial fibrillation and pulse pressure¹⁸. Nevertheless, as to pulse pressures, we have followed the ideas of Pastor-Barriuso et al.¹⁹ who have inferred, based on NHANES data, that: "The complexity of the association between pulse pressure and mortality has discouraged its use in prognosis or therapeutic decisions"¹⁹.

Thinking simplistically and speculating that there would be no risk of diastolic pressure elevation, we conclude that there would also be no damage to target-organs simply due to an isolated rise in this pressure. This type of reasoning needs to

Point of View

be duly demonstrated and confirmed, since the traditionally accepted idea is that an increase in diastolic pressure would damage the brain, heart, and kidneys, in the same way as an increased systolic pressure would.

This series of studies points to a possible future declassification of the clinical value of the diastolic level, since according to the abovementioned papers, no risk of death was found in patients with isolated diastolic hypertension that had been followed, in some cases, for many years. Only those patients who also showed elevated systolic levels were at risk.

All these studies led Beevers, in England, to recently declare that some clinicians and epidemiologists question if the diastolic pressure measurement is still worth the trouble, considering the outstanding importance of the systolic pressure in predicting cardiovascular risk and the reciprocal negation of diastolic pressure as a cardiovascular risk²⁰.

Even with all this evidence, prudence demands that after a century of monitoring arterial pressure in the traditional way,

we should still continue to pay attention to diastolic results, in spite of the fact that the studies mentioned above question whether it is really necessary.

Therefore, if systolic pressure is provenly important after 50 years, and if there is no recorded cardiovascular risk with isolated diastolic hypertension, we ask: In daily clinical practice, is the measurement of diastolic pressure necessary?

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

There were no external funding sources for this study.

Study Association

This study is not associated with any graduation program.

References

1. Kaplan NM. Clinical hypertension. 9th ed. Philadelphia: Lippincott; 2006. p. 123.
2. SHEP Cooperative Research Group. Final results of the systolic hypertension in the elderly. *JAMA*. 1991; 265: 3255-64.
3. Safar ME. Therapeutic trials and large arteries in hypertension. *Am Heart J*. 1988; 115: 702-10.
4. Hansson C, Zanchetti A, Carruthers SG, Dahlöf B, Elmfeldt D, Julius S, et al. for the HOT Study Group. Effects of intensive blood pressure lowering and low dose aspirin in patients with hypertension. *Lancet*. 1998; 351: 1755-62.
5. Kannel WB, Gordon T, Schwartz MJ. Systolic versus diastolic blood pressure and risk of coronary heart disease. *Am J Cardiol*. 1971; 27: 335-46.
6. Swales JD. Systolic versus diastolic pressure. *J Hum Hypertens*. 2000; 14: 477-9.
7. Izzo JL, Levy D, Black HR. Clinical advisor statement: interpretation of systolic blood pressure in older americans. *Hypertension*. 2000; 35: 1021-4.
8. Staessen JA, Thierys L, Fajard R, O'Brien ET, Clement D, de Leeuw PW, et al. Predicting cardiovascular risk using conventional vs ambulatory blood pressure in older patients with systolic hypertension. *JAMA*. 1999; 282: 539-46.
9. Burt VL, Whelton P, Roccella EJ, Brown G, Cutler JP, Higgins M, et al. Prevalence of hypertension in the US adult population: results from the Third National Health and Nutrition Examination Survey 1988-91. *Hypertension*. 1995; 25: 305-13.
10. Asmar R, Rudnichi A, Blacher J. Pulse pressure and aortic pulse wave are markers of cardiovascular risk in hypertensive populations. *Am J Hypertens*. 2001; 14: 91-7.
11. Vardan S, Mookherjee S. Perspective in isolated systolic hypertension in elderly patients. *Arch Fam Med*. 2000; 9: 319-23.
12. Lewington S, Clarke R, Qizilbash N, Peto R, Collins R. Age-specific relevance of usual blood pressure: a meta-analysis of individual data for one million adults in 61 prospective studies. *Lancet*. 2002; 360: 1903-13.
13. Fang J, Madhavan C, Cohen H, Alderman MH. Isolated diastolic hypertension: a favorable finding among young and middle-aged hypertensive subjects. *Hypertension*. 1995; 26: 377-82.
14. Hozawa A, Onkubo T, Nagai K, Kikuo M, Matsubaa M, Tsuji M, et al. Prognosis of isolated systolic and isolated diastolic hypertension as assessed by self-measurement of blood pressure at home: the Okasoma Study. *Arch Intern Med*. 2000; 160: 3301-6.
15. Benetos A, Frederique T, Safar ME, Bean KE, Guize L. Should systolic and diastolic blood pressure be considered for cardiovascular risk evaluation: a study in middle-aged men and women. *Hypertension*. 2001; 37: 163-8.
16. Strandberg TG, Salomaa VV, Vanhanen HT. Isolated diastolic hypertension, pulse pressure, and mean arterial pressure as predictors of mortality during a follow-up of 32 years. *J Hypertens*. 2002; 20: 399-404.
17. Pickering TG. Isolated diastolic hypertension. *J Clin Hypertens*. 2003; 5: 411-3.
18. Mitchell GF, Vasan MS, Keyes MJ, Panse H, Wang TJ, Larsen MG, et al. Pulse pressure and risk of new-onset atrial fibrillation. *JAMA*. 2007; 297: 709-15.
19. Pastor-Barriuso R, Banegas RJ, Damian SR, Appel GJ, Guallan E. Systolic blood pressure, diastolic blood pressure and pulse pressure: an evaluation of their joint effect on mortality. *Ann Intern Med*. 2003; 139: 731-9.
20. Beevers DG. Epidemiological, pathophysiological and clinical significance of systolic, diastolic and pulse pressure. *J Hum Hypertens*. 2004; 18: 531-3.