The Diastolic J Curve
Alive and Threatening

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Abstract—The occurrence of additional cardiovascular events when the diastolic blood pressure is lowered below a critical level is referred to as “the diastolic J curve.” Although the critical level of diastolic blood pressure where the J curve begins is not certain, increasingly strong evidence from prospective, controlled studies has confirmed the existence of such a J curve. With the likely addition of more patients who will be treated more vigorously, in particular, elderly subjects with isolated systolic hypertension, the potential for an increase in the number of adverse cardiovascular events must be considered and caution used to avoid too low a diastolic blood pressure. (Hypertension. 2011;58:751-753.)

Key Words: diastolic blood pressure ■ J curve ■ coronary risk

As we eagerly await delivery of the long delayed report of the eighth Joint National Committee, questions have emerged as to what may be advocated in the report. Among these questions is whether there will be recognition of the existence, significance, and prevention of a diastolic J curve, that is, the occurrence of additional cardiovascular events when the diastolic blood pressure is lowered beyond the level needed to maintain perfusion of vital organs.

Over the years since it was first described by Stewart in 1979,1 the J curve has been recognized to exist almost exclusively for the diastolic blood pressure level and mostly in patients with existing coronary artery disease.2,3 The exact location of where the critical diastolic J point has been reported to have progressively lower from Stewart’s initial report using 100 mm Hg with the fourth Korotkoff sound,1 to 85 mm Hg,4 then to 70 mm Hg,5 and now to 65 mm Hg,6 all using the fifth Korotkoff sound. The reasons why the level has apparently fallen over the years include the larger size of the populations studied in the trials, with the inclusion of many more patients with existing diabetes mellitus7 or coronary artery disease8,9 in whom more coronary events would more likely occur, the increase in reporting of diastolic levels in the publications of trial results, and the use of more cardioprotective drugs. The logical reasons for the almost exclusive occurrence of coronary events rather than strokes below the diastolic J point include the nature of coronary perfusion occurring only during diastole and the greater capacity of the cerebral circulation to autoregulate blood flow at lower blood pressure levels.10

The Critical Issue
As Bryan Williams has written11:

That there is a J-curve relationship between the level of blood pressure and risk is not in doubt, because there must come a point at which [blood pressure] BP becomes too low to sustain adequate perfusion to vital organs and life itself. Thus, the essence of the debate is whether this curve exists in the range of BP at which patients might be exposed to further blood pressure lowering by treatment. . . This is a hugely important clinical dilemma, worthy of closer inspection and debate, not least of all because these analyses create the impression that therapeutic lowering of [diastolic BP] DBP, within a range frequently encountered in routine clinical practice, could be harmful to many millions of treated patients.

In the past, before the numerous trials where a J curve has been observed in patients who initially had diastolic pressures as high as 90 mm Hg, some proposed that the diastolic J curve could be an artifact of pre-existing low diastolic pressure. Boutitie et al12 analyzed individual patient data from 40,233 subjects and concluded that the increased risk seen in patients with low blood pressure was because of poor existing health leading to low blood pressure. That explanation now seems disproven, although no trials have been published that examine the benefits or dangers of varying levels of diastolic pressures brought down by therapy to as low as 65 mm Hg.

The Potential for Additional Harm
The potential for harm from too low a diastolic blood pressure is now of much greater concern because of recent calls for spreading and intensifying antihypertensive therapy to 3 groups, the elderly,13 blacks,14 and even normotensive subjects who are at higher risk because of existing cardiovascular disease.15 The rationale for treating more of the elderly comes in large part from the positive results of the Hypertension in the Very Elderly Trial in patients ≥80 years of age.16 The rationale for more intensive therapy for blacks...
comes from the knowledge that hypertension is more common, more destructive, and less well treated in blacks compared with other ethnic groups.\textsuperscript{17} The rationale for treating normotensive people at higher risk comes from the recognition that increased mortality from coronary disease and stroke is seen in people with levels of blood pressure well below 140/90 mm Hg.\textsuperscript{18}

At the same time, a partial dampening of enthusiasm for more intensive therapy has come from recently published data from large clinical trials that show no additional benefit but rather more adverse effects of more intensive lowering of blood pressure. These studies have included patients with coronary disease,\textsuperscript{8,9} elderly patients with isolated systolic hypertension,\textsuperscript{19} diabetics,\textsuperscript{7,20} a general population in Japan,\textsuperscript{21} and patients with chronic renal disease.\textsuperscript{22}

Nonetheless, we are almost certainly going to be urged to treat more people more vigorously in the forthcoming eighth Joint National Committee report. Even without certainty of where the J curve begins, caution is advised to avoid unintended harm when we push blood pressure down to provide the known benefits of adequate blood pressure control. The potential for more harm involves the fact that people with “naturally” low diastolic pressure of 70 mm Hg on no antihypertensive therapy already have a 3-fold greater prevalence of cardiovascular disease,\textsuperscript{23} likely from the arterial stiffness that accompanies aging and consequently lowers diastolic pressure.

At least 2 other factors may increase both the prevalence and dangers of a diastolic J curve, the natural extreme dipping of blood pressure during the night and the concomitant presence of orthostatic hypotension. The first hazard can only be recognized by automatic ambulatory blood pressure monitoring. Unfortunately, this procedure is rarely performed in the United States since reimbursement by third-party payers is severely restricted in a foolhardy attempt to save healthcare cost. In $\approx 10\%$ of hypertensives, the normal 10% to 15% fall in nocturnal blood pressure is “extreme.” Among a group of patients with stable coronary heart disease, the extreme dippers experienced significantly more episodes of myocardial ischemia.\textsuperscript{24} Among 575 elderly hypertensives on antihypertensive drug therapy, an increased number of strokes occurred among those with a nocturnal fall of diastolic blood pressure $<75$ mm Hg.\textsuperscript{25} These findings should serve as a warning against late evening or bedtime dosing of drugs that have rapid antihypertensive effects.

The second factor, orthostatic hypotension, is seen in $\approx 12\%$ of otherwise healthy people over age 65 years\textsuperscript{26} and may be intensified by drugs such as traditional $\beta$-blockers, which further accentuate the baroreceptor insensitivity that is usually responsible for the fall in blood pressure on standing. The presence of orthostatic hypotension has been associated with a 3.5-fold increase in the risk of coronary heart disease\textsuperscript{27} and has been shown to be even more harmful than even extreme nocturnal dipping.\textsuperscript{28} If looked for, orthostatic hypotension can usually be alleviated, but the careful measurement of supine and standing blood pressure is rarely performed in busy clinics and offices. Moreover, orthostatic hypotension is often accompanied by supine hypertension, which can be severe. As Goldstein and Sharabi note, “The combination of orthostatic hypotension and supine hypertension poses a challenging clinical dilemma because the clinician must balance the risk of chronic high blood pressure versus the immediate risk of falls and consequent morbid events.”\textsuperscript{26}

What are we to do with the typical 80-year-old patient with a blood pressure of 180/70 mm Hg? There are no drugs that only lower systolic pressure. Therefore, as we provide the benefits of lowering the systolic level toward the goal of 150 mm Hg, should we hold back if his diastolic level goes below 65 mm Hg, as is likely? If the patient has known coronary disease, the answer should likely be to go no further. However, most elderly people have some coronary disease, even if it has not become clinically evident. The question remains, should more therapy be given to lower persistently elevated systolic levels even if doing so could induce a J curve? The answer is not certain but, at the least, we should be aware of the potential for harm and proceed with great caution.

Disclosures

None.

References


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