Blood Pressure Targets After High-Risk Myocardial Infarction
Is It Time to Update the Guidelines?

Scott J. Denardo, R. David Anderson, Carl J. Pepine

In this issue of Hypertension, Thune et al. analyze data from theValsartan in Acute Myocardial Infarction Trial to assess the effect of antecedent hypertension and post-myocardial infarction (MI) blood pressure (BP) on adverse cardiovascular outcomes. Their results for acute MI patients with antecedent hypertension support previous reports of increased risk for adverse cardiovascular outcomes. In addition, their results for all of the post-MI patients, regardless of antecedent hypertension status, with excessively high or low systolic BP (extrapolating their 3 BP categories, essentially a “V”-shaped plot), are consistent with a majority of reports focusing on hypertension management for post-MI patients (essentially “J”- or “U”-shaped curves). Finally, their results for post-MI excessively high or low diastolic BP reportedly deviated in a similar manner but not significantly. The lack of a significant deviation was ascribed by the authors to an inadequate number of patients for analysis (602; representing 5.7% of the total cohort).

Those patients with excessively high or low diastolic BP represent a small but significant subpopulation of the patients that we see with acute MI (larger than that reported by Thune et al. because patients selected for the Valsartan in Acute Myocardial Infarction Trial excluded those with systolic BP <100 mm Hg). Most studies of hypertension management in coronary artery disease patients do suggest a “J”- or “U”-shaped relationship between outcome and diastolic BP. The mechanism accounting for increased adverse events with high diastolic BP has been hypothesized to involve a combination of multiple direct physiological effects, including increased peripheral resistance, increased steady component of left ventricular afterload, and increased wall stress in the proximal coronary vessels. Indeed, interventions that modify vascular loading are associated with reduced vascular events. Some opinions also suggest that coronary artery plaque growth may be reduced at lower-than-normal BP. These notions have fueled the “lower is better” paradigm for BP that is currently advocated for low-density lipoprotein cholesterol and is also gaining momentum for hyperglycemia post-MI.

Conversely, the mechanism accounting for increased adverse events with excessively low diastolic BP is more difficult to explain. There are many possibilities involving a potential combination of both direct and indirect effects (Table): (1) ischemia resulting from decreased myocardial perfusion; (2) increased pulse pressure reflecting large artery stiffness, thus a marker for more advanced vascular disease; and/or (3) an epiphenomenon related to another underlying chronic illness, thereby increasing morbidity and mortality (reverse causality). Consistent with the first possibility, an analysis from the International Verapamil SR-Trandolapril Study, which focused on patients with stable coronary artery disease and hypertension, found a “J” shaped relationship between outcome (as death, nonfatal MI, or nonfatal stroke) and diastolic BP for the entire cohort. However, the relationship is least prominent for those with previous revascularization (including surgical bypass grafting and/or percutaneous coronary intervention as a single group). A more detailed but preliminary analysis suggests that those patients with previous bypass grafting only do not show an increase in events at lower diastolic BPs. For that group, the relationship was relatively linear and positive at the same low diastolic pressure (ie, progressively lower pressures correlated with better outcomes). Interestingly, those patients also had the lowest prevalence of angina, suggesting that, among the previous revascularization subgroups, they had the most complete revascularization. Therefore, with the upstreamstenosis bypassed, they could better tolerate the lower perfusion pressure from the standpoint of myocardial perfusion and yet simultaneously receive the other benefits of low diastolic BP.

So it appears that, with the exception of clinically stable coronary artery disease patients who have undergone previous bypass grafting, the optimal BP after MI is somewhere in the range of 120 to 139/75 to 89 mm Hg. However, current guidelines for the management of BP after ST segment and non-ST segment elevation MI recommend a target BP of <140/90 mm Hg (except for in the presence of diabetes mellitus and/or renal failure, the target is <130/80 mm Hg), with no reference to a lower limit. In addition, current messages on secondary prevention state explicitly, “blood pressure: lower is better.” This position may have been induced, in part, by the success of statin therapy for the management of dyslipidemia after acute coronary syndrome where it seems that, for low-density lipoprotein cholesterol, lower is better. In addition, these presentations cite the Prospective Studies Collaboration, where a log-linear and positive correlation between BP and adverse outcome was documented. However, close inspection of those...
data reveals that, for lower pressures (but not excessively so: systolic BP <125 mm Hg and diastolic BP <85 mm Hg, respectively), and especially for ages ≥70 years, there is a "J"-shaped curve if excessively low pressures had been included. The results of Thune et al, the International Verapamil SR-Trandolapril Study, and others who include excessively low pressures for analysis do show a “V”, “J”, or “U”-shaped curve and, therefore, suggest that there should be a lower limit set for the target systolic and diastolic BP except for, perhaps, diastolic BP in patients with previous bypass grafting.

Is it, therefore, time to update the acute MI guidelines to include a lower limit to the target BP? No, not yet, but some caution might be prudent until more data are available. If an appropriately powered randomized trial confirms that excessively low BP (<120/75 mm Hg) indeed increases adverse outcomes, compared with patients assigned a low BP target (120 to 130/75 to 80 mm Hg), then the time will be on us to update the guidelines.

Disclosures

None.

References


Table. Possible Mechanisms Accounting for Increased Adverse Events in Coronary Artery Disease Patients With Excessively Low Diastolic BP

Ischemia-related consequences (eg, MI, heart failure, and arrhythmias) resulting from decreased myocardial perfusion, which occurs primarily during diastole. Decreased diastolic pressure time, the principal hydraulic determinant for flow, becomes critical for maintaining flow with upstream stenoses. Increased pulse pressure reflecting stiffer large arteries is a marker for more advanced vascular disease. However, this greater pressure pulsation should result in greater coronary vessel diameter pulsation and stretch of endothelial cells. These stimuli should result in an increase and redistribution of force across endothelial cells to activate signaling molecules that promote more microvascular dilation. However, with upstream stenoses, the microvessels may already be maximally dilated and critically dependent on the diastolic pressure time to maintain flow.

Epiphenomenon related to an undetected underlying illness (eg, cancer, diabetes, or renal insufficiency), thereby increasing morbidity and mortality for other reasons (reverse causality).

Combinations of the above.
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