Cold, calcium and hypertension; is there a relationship between them?

Murat Celik¹, Turgay Celik²

¹Service of Cardiology, Van Army District Hospital, Van, Turkey.  
²Department of Cardiology, Gulhane Military Medical Academy, Ankara, Turkey.

In their study published in this issue of the Journal of Experimental and Integrative Medicine, Kozyreva et al [1] touched upon a quite interesting topic; the relationship between thermoregulation and immune system under the exposure of cold, and the modulator effect of exogenous Ca²⁺ in hypertensive and normotensive rats. In that study, they observed that in thermoneutral conditions, the difference between hypertensives and normotensives in immune response parameters was small, some calcium-dependent mechanisms of immune response development can possibly be blocked by cold, and deep cooling on the background of administered Ca²⁺ caused significant stimulation instead of suppression of the immune response in rats with arterial hypertension compared to normotensives. These observations can be explained not only the functional vascular properties of blood vessels, but also other physiological systems and molecular mechanisms involving in the response to cold in hypertensives.

The prevalence of hypertension is increased in people who live in cold regions and during the winter [2]. Cold temperatures have adverse effects on the human cardiovascular system and trigger myocardial infarction and stroke in hypertensive patients [3]. Inflammation seems to have an increasingly important role in the pathogenesis of hypertension, and several studies indicated that exposure to cold may cause inflammation in the cardiovascular system and kidneys, as evidenced by up-regulation of pro-inflammatory cytokines, and an increase in leukocyte infiltration and protein expression [4, 5]. Thus, the adverse effects of cold exposure on the cardiovascular system can be explained by this elevated inflammation. Nevertheless, endothelium plays a crucial role in the maintenance of vascular structure, control of vascular tonus, homeostasis, and inflammation. Recent studies indicated that cold exposure increased the generation of reactive oxygen species such as superoxide [5], suppressed the production of nitric oxide (NO) [4], and increased endothelin-1 (ET-1) levels in cardiovascular and renal tissues [6]. Thus, cold exposure can lead to oxidative damage in the vasculature resulting in endothelial dysfunction. Since endothelial dysfunction has been supposed to be the first step of the pathogenesis of atherosclerosis, it becomes even more important. Maybe, the question of why so many patients with atherosclerosis are seen in the Scandinavian countries can be answered by the cause-and-effect relationship between cold exposure, hypertension and vascular inflammation. Additional investigation into the molecular mechanism would be of particular interest.

Calcium plays an important role in mediating vascular contraction and has an important role in the development of the immune response, especially during its early stages. The present study shows that metabolic response and vascular response became more marked during deep cooling on the background of administered Ca²⁺ in hypertensive rats compared to normotensives. This increased sensitivity of hypertensives to Ca²⁺ may affect the immune processes and vascular inflammation, and may be another cause of adverse effects of cold temperature on the cardiovascular system. Nevertheless, a recent study by Bolland et al [7] showed that calcium supplementation in healthy postmenopausal women is associated with upward trends in cardiovascular event rates. For these reasons, the use of calcium supplementation in medical treatment may require a separate attention in hypertensive postmenopausal women who live in cold region and during the winter. Also, this issue would be of particular interest of another study.

Although Kozyreva et al [1] did not intend to investigate the relationship between cold, calcium and hypertension, this present study might be accepted as a primary study for elucidating the possible effects of cold and calcium on cardiovascular system. However, further work, experimental studies as well as large-scale randomized trials, are needed to demonstrate this relationship.
References

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Correspondence:
M. Celik
Service of Cardiology,
Van Army District Hospital,
65040, Van, Turkey.
drcelik00@hotmail.com

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