ACADEMIC PRESS

Cryobiology 44 (2002) 54–61

CRYOBIOLOGY

www.academicpress.com

# Role of elastic fibers in cooling-induced relaxation☆

B. Herrera, M.M. Desco, G. Eisenberg, P. García-Barreno, and J.F. Del Cañizo*

*Unidad de Medicina y Cirugía Experimental, Hospital General Universitario "Gregorio Marañón," C/Dr. Esquerdo 46, 28007 Madrid, Spain*

Received 4 December 2001; accepted 22 January 2002

**Abstract**

The objective of this work was to confirm the main role of elastic fibers in differing responses of certain vessels during cooling from 37 to 8 °C. Previous results have shown that the nature of the vessel (conduit vessel vs muscular vessel) determines the different behavior (dilatation vs contraction) of isolated vessel segments when temperature decreases from 37 to 8 °C. In this work, it has been demonstrated that vessels with a great amount of elastic fibers show a dilatation when cooling. On the other hand, muscular vessels with fewer elastic fibers, such as the renal artery, undergo a contraction. The output of calcium from intracellular stores causes contraction of the renal artery during cooling. In this vessel, vasodilatation occurs only when mechanisms of smooth muscle contraction are inactive, as is the case with vessels that have undergone a cold storage period of 48 h. The results presented in this work confirm that there are two main effects, which directly depend on the vessel origin. In conduit arteries, the decrease of temperature induces a vascular relaxation, dependent on the elastic component of the vessel wall. In muscular vessels, the predominant effect is cooling-induced contraction due to an increase of intracellular calcium. This cooling-induced contraction needs the vessel to be in optimal conditions with an active metabolism of the muscular cells. These results are a crucial issue in the sense of explaining several biomedical mechanisms where hypothermia is implicated. The type of vessel implicated in procedures, such as isolated organ perfusion, extracorporeal circulation, and bypass surgery, must be taken into account. 

*Keywords:* Vessel contraction; Dilatation; Temperature; Hypothermia

The effect of temperature on vascular responses to several agonists, such as noradrenaline [9,24], 5-HT [4,18], potassium channel openers [19], and acetylcholine [8], has been studied in depth in recent years. On the other hand, the direct effect of temperature on the vascular tone has been much less studied.

In a preliminary study [10], we reported a paradoxical effect of temperature on vascular tone. As a working hypothesis, we contended that, just as the effect of temperature on pig renal artery (cooling-induced contraction; CIC) was due to a metabolic mechanism, the effect on rat aorta (cooling-induced relaxation) could be due to the specific composition of the arterial wall. The latter

☆ This research was partially supported by Fondo de Investigación Sanitaria under Contract FIS 00/0013-02.

* Corresponding author. Fax: +34-91-5868104.

*E-mail address:* canizo@mce.hggm.es (J.F. Del Cañizo).

0011-2240/02/$ - see front matter 
PII: S0011-2240(02)00004-4