



Review

Gap junctions synchronize vascular tone within the microcirculation

Volker J. Schmidt, Stephanie E. Wölfle, Markus Boettcher, Cor de Wit

Institut für Physiologie, Universität zu Lübeck, Ratzeburger Allee 160, 23538 Lübeck, Germany

Correspondence: Cor de Wit, e-mail: dewit@uni-luebeck.de

Abstract:

Gap junctions are formed in the cardiovascular system by connexin40 (Cx40), Cx37, Cx43, and Cx45. These low resistance channels allow the transfer of ions and small molecules between cells. The longitudinal coupling of endothelial and smooth muscle cells *via* gap junctions allows the spread of changes in membrane potential along the vascular wall and hence provides conduction pathways within the vessel itself. Functionally, this tight coupling is reflected by the spread of locally initiated vasomotor responses along the arteriole which are termed conducted responses. Conducted dilations are initiated by the application of endothelium-dependent stimuli which result in local hyperpolarization. This signal spreads along the wall, most likely along the endothelial cell layer, to elicit a coordinated dilation of the arteriole over a considerable distance. Likewise, the opposite signal (depolarization) spreads along the vessel giving rise to a conducted constriction. The latter response is however most likely transmitted along the smooth muscle cell layer. Thus, conducted responses reflect the synchronized behavior of the cells of the vascular wall. It is assumed that conducted responses are critical for the matching of oxygen delivery and tissue needs because they contribute to an ascending dilation which lowers resistance along the length of the arterioles and upstream vessels in a well-tuned fashion. Herein, Cx40 is of special importance because it is critically required for intact signal transduction along the endothelial cell layer. In addition, Cx40 mediates pressure feedback inhibition on renin synthesis in the kidney. Both, vascular and renal function of Cx40, may be involved in the hypertension that is observed in Cx40-deficient animals. In this review, we will summarize physiologic function of connexins in arterioles and briefly address their role in the kidney with respect to renin secretion.

Key words:

arterioles, endothelium, gap junctions, conducted response
