Role of renal vascular potassium channels in physiology and pathophysiology

The control of renal vascular tone is important for the regulation of salt and water balance, blood pressure and the protection against damaging elevated glomerular pressure. The K+ conductance is a major factor in the regulation of the membrane potential (Vm) in vascular smooth muscle (VSMC) and endothelial cells (EC). The vascular tone is controlled by Vm via its effect on the opening probability of voltage operated Ca2+ channels (VOCC) in VSMC. When K+ conductance increases Vm becomes more negative and vasodilation follows, while deactivation of K+ channels leads to depolarization and vasoconstriction. K+ channels in EC indirectly participate in the control of vascular tone by endothelium derived vasodilation. Therefore, by regulating the tone of renal resistance vessels, K+ channels have a potential role in the control of fluid homeostasis and blood pressure as well as in the protection of the renal parenchyma. The main classes of K+ channels (calcium activated (KCa), inward rectifier (Kir), voltage activated (Kv) and ATP sensitive (KATP)) have been found in the renal vessels. In this review, we summarize results available in the literature and our own studies in the field. We compare the ambiguous in vitro and in vivo results. We discuss the role of single types of K+ channels and the integrated function of several classes. We also deal with the possible role of renal vascular K+ channels in the pathophysiology of hypertension, diabetes mellitus and sepsis. This article is protected by copyright. All rights reserved.