EXPANDED ABSTRACT

K^+ channels on resting duct cells from rat pancreas

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Abstract : The ductal system of the exocrine pancreas produces HCO_3^--rich fluid in response to secretin and other stimuli. HCO_3^- efflux across the luminal membrane is mediated by a Cl^--HCO_3^- exchanger operating in parallel with the cystic fibrosis transmembrane conductance regulator (CFTR) Cl^- channel. Basolateral K^+ channels provide an exit pathway for K^+ and play a vital role in maintaining the membrane potential, which is a crucial component of the driving force for anion secretion. Measurements of membrane potential with intracellular microelectrodes suggested that Ba^{2+}-sensitive K^+ conductance accounts for more than 60% of the total basolateral ionic conductance in resting ducts (1). To identify the Ba^{2+}-sensitive K^+ channels, we isolated ducts from normal rat pancreas by collagenase digestion. We first demonstrated that the ducts did not express a vascular endothelial marker PECAM-1 (platelet/endothelial cell adhesion molecule-1), but expressed cytokeratin 20, a marker of duct cells (2), using immunofluorescent staining. In addition, monoclonal anti-CFTR antibody was detected near the luminal membrane of these cells. In cell-attached single-channel recordings, we observed three types of K^+ channels on basolateral membrane in unstimulated duct cells. The 40 pS K^+ channels are likely to mediate whole-cell inwardly rectifying K^+ (Kir) currents, which were blocked by extracellular Ba^{2+} in a voltage-dependent manner. The properties of 90 pS and 170 pS K^+ channels are similar to those of Ca^{2+}-activated K^+ channels. We then identified Kir2.0 and SK4/IK1 (intermediate conductance Ca^{2+}-activated K^+ channel) subunits as molecular candidates of the K^+ channels using RT-PCR analysis. The present results suggest that these subunits may mediate native K^+ currents in resting duct cells. Further functional studies with specific blockers are required to evaluate which of these K^+ channels contribute to the resting membrane potential and might be involved in HCO_3^- secretion. J. Med. Invest. 56 Suppl. : 354, December, 2009

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REFERENCES

1. Novak I, Greger R : Effect of bicarbonate on potassium conductance of isolated perfused rat pancreatic ducts. Pflügers Arch 419 : 76-83, 1991
2. Bouwens L, Braet F, Heimberg H : Identification of rat pancreatic duct cells by their expression of cytokeratins 7, 19, and 20 *in vivo* and after isolation and culture. J Histochem Cytochem 43 : 245-253, 1995