Role of potassium and chloride channels in the generation of spontaneous activity in the prostate gland

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The spontaneous electrical activity in the guinea-pig prostatic stroma generally consists of transient membrane depolarisations which trigger a number of nifedipine-sensitive spikes, resembling 'slow waves' in the intestine, urethra and mesenteric lymphatics. Recently, we have also recorded 'pacemaker activity' in 10-20% of all impalements. This activity is distinctly different to the slow waves and consists of a larger, biphasic waveform that may well arise from the c-Kit positive interstitial cells which we've identified in this organ (1). In this study, the role of potassium and chloride channels in the generation of the spontaneous electrical activity in the guinea-pig prostate was examined using intracellular microelectrodes. Prostate glands were removed from guinea-pigs (250-350g) killed humanely by stunning and exsanguination. Saccular glands were pinned to the bottom of an organ bath, which was subsequently mounted on an inverted microscope stage and perfused with physiological saline solution. Tetraethylammonium (TEA 300 μM and 1mM) and 4-aminopyridine (4-AP 1mM), blockers of BK_{Ca} and 4-AP-sensitive K^+ channels, respectively, increased the frequency of slow wave discharge. 4-AP significantly increased the duration of the depolarising transient of the slow wave and pacemaker potentials. Blockade of SK_{Ca} and ATP-dependent K^+ channels using apamin (1-200nM) and glibenclamide (1 μM), respectively had no effect on slow wave activity. However, the inhibitory actions of sodium nitroprusside and CGRP were readily reversed by glibenclamide. Finally, the chloride channel blockers, DIDS (2mM), niflumic acid (10-100μ M) and 9-anthroic acid (100 μM) significantly reduced the frequency of slow wave activity in nifedipine-arrested preparations. These inhibitory effects were readily reversed upon washout. Our results suggest that BK_{Ca}, 4-AP-sensitive K^+ and chloride channels modulate the frequency of electrical discharge in the guinea-pig prostate gland.

(1) B. Exintaris, M.F. Klemm, and R.J. Lang, Spontaneous slow wave and contractile activity of the guinea pig prostate. J Urol, 2002. 168(1): p. 315-22.