PROPERTIES AND REGULATION OF CARDIAC CHLORIDE CHANNEL

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Summary

1. Properties of the cyclic AMP-regulated Cl^- channel were studied in guinea-pig ventricular myocytes with the patch clamp technique. Cell-attached patch recordings were performed, while the cell was dialyzed with a cyclic AMP-containing internal solution through a second patch pipette. In addition, Cl^- channel currents could also be recorded in the outside-out patched excised from the cyclic AMP-loaded cells. The channel seemed to have at least one open state and two closed states; the open-time histograms showed one exponential component with a time constant of about 1 s, while the closed-time histograms showed two exponential components with time constants of about 0.2 and 1 s. These time constants showed no clear voltage-dependence. The current-voltage relation of the Cl^- current observed in the outside-out patches showed outward rectification under the condition of symmetrical Cl^- gradients, suggesting that the channel itself or related structure has a property to rectify the current flow. The inward channel currents observed in the outside-out patches did not show any bursting activity, suggesting that the high-frequency closures during the burst seen in the cell-attached patches reflect fast-blocking phenomena caused by some intracellular substances.

2. In the whole cell clamp study performed in ventricular and atrial myocytes, external application of ATP (5 - 50 μM) was found to induce a Cl^- current, in addition to a rapidly desensitizing cation-selective current. A nonhydrolyzable ATP analogue, ATPγS, also evoked these two currents, indicating involvement of purinoceptors rather than ecto-ATPase on the membrane. ADP, AMP, and adenosine were also effective in inducing the Cl^- current, showing no clear order of potency for the purinoceptor subtypes involved. The purinoceptor-activated Cl^- current, like the β-catecholamine-cyclic AMP-dependent cardiac Cl^- current, showed outward rectification and time-independence.