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全细胞膜片钳法研究铜对急性分离大鼠海马细胞钾电流的影响

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摘要 应用全细胞膜片钳技术, 在急性分离的大鼠海马锥形细胞上研究了铜对瞬间外向钾电流 (I_{to}) 和延迟整流钾电流 (I_{dr}) 的影响。外液中低浓度的 Cu^{2+} 增强 I_{to} 和 I_{dr} 电流, 而高浓度的 Cu^{2+} 则抑制 I_{to} 和 I_{dr} 电流。动力学研究表明: I_{to} 电流的激活和失活过程不受胞外 10^{-5} mol/L Cu^{2+} 的影响; 而胞外 10^{-5} mol/L Cu^{2+} 可以使 I_{dr} 的激活曲线向正电位方向移动, 但不改变其斜率。结果表明胞外 Cu^{2+} 可能参与神经退行性疾病的形成。

关键词 [全细胞膜片钳](#), [海马细胞](#), [铜 \(II\)](#), [钾电流](#), I_{to} , I_{dr}

分类号

Effect of Cu^{2+} on K^+ Current in Acutely Isolated Rat Hippocampal Neurons by Whole Cell Patch Clamp Technique

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Abstract Using the whole cell patch clamp technique, the effect of Cu^{2+} on transient outward K^+ current (I_{to}) and delayed rectifier K^+ current (I_{dr}) was studied in acutely isolated rat hippocampal neurons. I_{to} and I_{dr} were increased when the concentration of Cu^{2+} was lower than 2×10^{-5} and 10^{-5} mol/L, respectively, and increased ratio was decreased with increasing Cu^{2+} concentration in the bath solutions. When the concentration continued to increase to 5×10^{-5} and 2×10^{-5} mol/L, the currents were hardly changed, while the concentration was more than 10^{-4} and 5×10^{-5} mol/L, the currents were inhibited remarkably. Cu^{2+} (10^{-5} mol/L) did not affect the activation and inactivation process of I_{to} . The activation curve of I_{dr} was shifted toward positive potential, but 10^{-5} mol/L Cu^{2+} did not affect slope factor. According to these results, it was considered that Cu^{2+} at low concentration in the bath solution could promote I_{to} and I_{dr} while at high concentration could inhibit them, and change of amplitude was different with different membrane voltage. Conclusion was drawn: Cu^{2+} may be involved in the pathophysiologic mechanism of diseases with neuropathological components.

Key words [whole cell patch clamp technique](#) [hippocampal neurons](#) [copper\(II\)](#) [potassium current](#) [transient outward potassium current](#) [delayed rectifier potassium current](#)

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