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# Acetylcholine-Induced Calcium Current and Oscillation in Mouse Eggs

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Our previous study has suggested that muscarinic receptor present in the mouse oocytes, and $Ca^{2+}$ waves elicited by acetylcholine (ACh) are similar to those induced by sperm. A numerous study reported that ACh could cause early activation events in mouse oocytes overexpressing the M1 muscarinic receptor (Williams et al., 1992; Moore et al., 1993; Kim et al., 1998). However, the physiological role of ACh during mouse embryonic development is poorly understood. In this study, we examined if ACh causes the changes in the $Ca^{2+}$ current and $Ca^{2+}$ transient correlated with the early development of the mouse eggs. Confocal microscopy and patch clamp study were used to examine ACh-induced $Ca^{2+}$ transient and $Ca^{2+}$ current. Amplitude of $Ca^{2+}$ peak current during embryonic development were $2.76 \pm 0.01$, $2.54 \pm 0.05$, $2.06 \pm 0.02$, $1.18 \pm 0.16$ and $0.37 \pm 0.07$ nA in ovulated oocytes, zygote, 2-cell, 4-cell and 8-cell embryo, respectively. The $Ca^{2+}$ peak current progressively reduced during embryonic development. Treatment of these eggs with ACh showed that ACh increased significantly ($p<0.05$) $Ca^{2+}$ peak current only in ovulated oocytes. Also, ACh changed $Ca^{2+}$ transients during embryonic development. In zygotes ($1257.8 \pm 326.8$, n=15), 2-cell ($1898.0 \pm 423.5$, n=10), 4-cell ($1203.0 \pm 45.9$, n=10) and 8-cell ($1103.0 \pm 102.3$, n=10), ACh elicited $Ca^{2+}$ transients having a larger peak against relative intensity of ovulated oocytes ($1140.5 \pm 592.8$). However, ACh generated oscillatory $Ca^{2+}$ transients only in ovulated oocytes. In ovulated oocytes, the overall pattern of $Ca^{2+}$ oscillatory waves was regular periodic waves (69%). From these results, we suggest that ACh affect regulation of intracellular $Ca^{2+}$ concentration mainly in mouse oocytes rather than in embryonic development.

Key words) ***Acetylcholine, $Ca^{2+}$ peak current, $Ca^{2+}$ transient, Egg***