Effect of the Lectin Concanavalin-A on Calcium-Regulated Adenosine 3',5'-Monophosphate Accumulation in Bovine Parathyroid Cells

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Abstract

Extracellular calcium (Ca\(^{2+}\)) is the major physiological regulator of parathyroid function; high Ca\(^{2+}\) decreases PTH secretion as well as reduces cAMP accumulation. There is an increasing body of evidence suggesting the presence of a receptor-like mechanism at the surface of the parathyroid cell which mediates these and other actions of Ca\(^{2+}\). In the present studies we used the lectin Concanavalin-A (Con-A) to investigate the possible role of carbohydrate moieties in the regulation of cAMP metabolism by Ca\(^{2+}\) in bovine parathyroid cells, which is thought to involve inhibition of adenylate cyclase via activation of the guanine nucleotide regulatory protein G\(_i\). Pretreatment of parathyroid cells with Con-A for 15–60 min significantly reversed the inhibitory effect of high Ca\(^{2+}\) on dopamine-stimulated cAMP accumulation, reducing the inhibition at 3 mM Ca\(^{2+}\) from 70 ± 3% to 30 ± 3%. This effect was also observed in the absence of preincubation and with concentrations of Con-A as low as 40 µg/ml and was reversed by α-methyl-D-glucoside, a specific antagonist of the lectin. The lectin also reversed the inhibitory effects of Ca\(^{2+}\) (2–3 mM) on cAMP accumulation stimulated by isoproterenol and forskolin to a comparable extent. Prostaglandin F\(_{2\alpha}\)-induced inhibition of cAMP accumulation (likewise mediated by G\(_i\)) was, however, not reversed by Con-A, suggesting that the lectin did not have a generalized effect on the cell surface or on receptors inhibiting adenylate cyclase. Moreover, fluoride-induced inhibition of cAMP accumulation was not reversed by Con-A, providing additional evidence that the lectin did not act at or distal to G\(_i\) (i.e. modulate G\(_i\), adenylate cyclase, and/or phosphodiesterase). The present study suggests that Con-A may modulate the actions of extracellular Ca\(^{2+}\) on parathyroid secretion, possibly modifying the interaction of Ca\(^{2+}\) with the cell surface by affecting carbohydrate moieties that seem to be important in the Ca\(^{2+}\)-sensing process. The structural element involved in Ca\(^{2+}\) sensing in the parathyroid cell may be a glycoprotein or closely associated with glycoproteins with carbohydrate chains containing α-methyl-D-glucoside. (Endocrinology 126: 1996–2002,1990)

Footnotes
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