Depolarization evoked release of D-[^{3}H]aspartate from slices of substantia nigra: Effects of dopamine receptor ligands

José Abarca, Gonzalo Bustos

Abstract

A superfusion system was used to study the effects of dopamine receptor agonists and antagonists on spontaneous and stimulus-evoked release of D-[^{3}H]aspartic acid preaccumulated by slices of rat substantia nigra. Electrical field stimulation (20 Hz, 1.0 V, 2 min) produced a 2.4-fold increase in D[^{3}H]aspartate release from nigral slices. Omission of Ca^{2+} and increasing Mg^{2+} to 12 mM, or addition of tetrodotoxin (0.1 μM) to the superfusion medium, substantially blocked D-[^{3}H]aspartate release induced by electrical stimulation. Apomorphine (50–100 μM), a dopamine receptor agonist, significantly enhanced the Ca^{2+}-dependent, electrically-evoked release of D-[^{3}H]aspartate from nigral slices. Other dopamine receptor ligands, such as 2-amino-6,7-dihydroxy-1,2,3,4-tetrahydronaphthalene (100 μM), also enhanced the stimulus-evoked release of the [^{3}H]amino acid regardless of whether the stimuli applied were electrical or chemical. None of the dopamine receptor agonists tested were able to modify the spontaneous release of D-[^{3}H]aspartate. Haloperidol (25 μM) and (+) butaclamol (10 μM), two well known dopamine receptor antagonist, had no effect on stimulus-evoked release of D-[^{3}H]aspartate from nigral slices but they completely prevented the apomorphine (50 μM)-mediated enhancement of stimulus-evoked release of [^{3}H]amino acid. In contrast, (−) butaclamol, which is devoid of dopamine receptor blocking properties, had no effect on stimulus-evoked or on apomorphine-mediated facilitation of evoked-release of D-[^{3}H]aspartate. The results shown support the idea that activation of nigral dopamine receptors may facilitate the Ca^{2+}-dependent, depolarization induced-release of excitatory amino acid transmitters from neuronal structures in substantia nigra. The proposition is made that some of these dopamine receptors might be located in cortico-nigral nerve terminals.