Direct effect of hypothalamic neuropeptides on the release of catecholamines by adrenal medulla in sheep – study ex vivo

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Abstract

Stress causes the activation of both the hypothalamic-pituitary-adrenocortical axis and sympatho-adrenal system, thus leading to the release from the adrenal medulla of catecholamines: adrenaline and, to a lesser degree, noradrenaline. It has been established that in addition to catecholamines, the adrenomedullary cells produce a variety of neuropeptides, including corticoliberine (CRH), vasopressin (AVP), oxytocin (OXY) and proopiomelanocortine (POMC) – a precursor of the adrenocorticotropic hormone (ACTH). The aim of this study was to investigate adrenal medulla activity in vitro depending, on a dose of CRH, AVP and OXY on adrenaline and noradrenaline release. Pieces of sheep adrenal medulla tissue (about 50 mg) were put on 24-well plates and were incubated in 1 mL of Eagle medium without hormone (control) or supplemented only once with CRH, AVP and OXY in three doses (10⁻⁷, 10⁻⁸ and 10⁻⁹ M) in a volume of 10 μL. The results showed that CRH stimulates adrenaline and noradrenaline release from the adrenal medulla tissue. The stimulating influence of AVP on adrenaline release was visible after the application of the two lower doses of this neuropeptide; however, AVP reduced noradrenaline release from the adrenal medulla tissue. A strong, inhibitory OXY effect on catecholamine release was observed, regardless of the dose of this hormone. Our results indicate the important role of OXY in the inhibition of adrenal gland activity and thus a better adaptation to stress on the adrenal gland level.

Key words: hypothalamic neurohormones, adrenal gland, adrenaline and noradrenaline release

Introduction

The fundamental process of life is maintaining homeostasis in a permanently changing environment. The hypothalamic-pituitary-adrenocortical axis (HPA) is the principal component required for adaptation. The Corticotropin-Releasing Hormone (CRH) and arginine vasopressin (AVP) are the main hypothalamic factors for releasing by stress the adrenocorticotropic hormone (ACTH) and adrenocortical glucocorticoids, most often cortisol, which are the final effectors of the HPA axis. Apart from stress