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Measurement of somatostatin release in rat brain by microdialysis

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Abstract

We determined the most suitable conditions for measuring the somatostatin (SRIF) level by brain microdialysis and investigated its release from the hypothalamus. The relative recovery rate of SRIF was $8.4 \pm 0.5\%$ (mean $\pm$ SE) using a polycarbonate (PC) membrane with the push-pull method at a flow rate of 2 μl/min. Using tubes with an internal diameter of 0.28 mm and lengths of 5, 25, 50 and 100 cm, the relative recovery rates using a PC membrane with the push method were $8.2 \pm 0.5\%$, $7.3 \pm 0.6\%$, $6.2 \pm 0.5\%$ and $4.1 \pm 0.6\%$, respectively. When using tubes with an internal diameter of 0.1 mm and lengths of 5, 25, 50 and 100 cm, the relative recovery rates were $7.3 \pm 0.7\%$, $5.6 \pm 1.0\%$, $3.5 \pm 1.1\%$ and $1.4 \pm 0.7\%$, respectively. The relative recovery rate was $5.2 \pm 0.5\%$ with a polysulfone (PS-F, Fresenius) membrane, $4.5 \pm 0.4\%$ with a PS-H (Hospal) membrane, $2.6 \pm 0.2\%$ with an ethylenevinyl alcohol membrane (EVAL), $5.1 \pm 0.8\%$ with a polyvinyl alcohol (PVA) membrane and $10.4 \pm 0.8\%$ with a PS-K (Kaneka) membrane. With the push method, the extracellular SRIF level in rat pituitary was 42.8 ± 1.8 pg/ml with a PC membrane, 23.1 ± 2.9 pg/ml with an EVAL membrane at a flow rate of 2 μl/min. With the push-pull method, it was 52.7 ± 5.2 pg/ml using a PC membrane, 33.5 ± 2.8 pg/ml using a PVA membrane and 54.4 ± 3.2 pg/ml using a PS-K membrane. Intraperitoneal injection of urethane significantly increased SRIF from a basal level of 36.8 ± 10.6 pg/ml to 66.6 ± 12.5 pg/ml ($P < 0.05$) after 1 h; however, pentobarbital decreased it from 44.7 ± 4.1 pg/ml to 16.0 ± 4.6 pg/ml after 1 h. These data, which give optimum microdialysis conditions for measuring SRIF release in the rat, were useful for measuring the physiological release of SRIF from the hypothalamus.

Key words: Somatostatin; Microdialysis; Anterior pituitary gland; Pentobarbital; Urethane

1. Introduction

The push-pull perfusion method with a push-pull cannula has been used to obtain samples for measuring substances released in the brain under anesthetic-free, non-immobilized conditions (Kasting et al., 1981; Fukata et al., 1985). However, the problems with this method are that the pressurized stream of perfusate may seriously injure the tissue, and it is difficult to determine adequate push-pull conditions. To overcome these problems, Ungerstedt et al. (1982) developed a brain microdialysis method using a cannula the tip of which was sheathed with a dialysis membrane. This method was first applied to the in vivo analysis of monoamines, their metabolites and other classical transmitter substances of low molecular weight such as amino acids and acetylcholine. With the development of dialysis membranes and systems for sampling and analysis, brain dialysis has also been used in the determination of such neuropeptides as cholecystokinin (Hurd, 1989; Kato, 1989; DeMesquita et al., 1989; Takita et al., 1989), insulin-like growth factor I (Yamaguchi et al., 1991), neurokinin A (Lindefors et al., 1985, 1989b), neurotensin (Bean et al., 1989), opioids (Maidment et al., 1989), oxytocin (Kendrick et al., 1988a,b; Caldwell et al., 1989; Kendrick and Keverne, 1989; Hattori et al., 1990) and substance P (Brodin et al., 1983, 1987; Lindefors et al., 1985, 1986, 1987, 1989a,b; Morilak et al., 1988). However, because the recovery of these hormones and the sensitivity of the assay systems were unsatisfactory, the only hypophysiotropic hormone the release of which has been studied

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