INFLUENCE OF PARATHYROID HORMONE ADMINISTRATION ON CALCITONIN SECRETION IN THE PIG

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Calcitonin (CT) is the hypocalcemic, hypophosphatemic hormone produced and secreted by the thyroid gland of most mammalian species. Although parathyroid hormone (PTH) plays a dominant role in the control of calcium homeostasis within the body, CT may be involved in the fine regulation of plasma calcium (1). This is particularly true during periods of hypercalcemic stress such as after the ingestion of a high-calcium meal (2, 3).

Plasma calcium levels are known to control the secretion of CT directly in a positive feedback manner (4, 5). However, other biochemicals such as gastrin, glucagon, and cyclic AMP (1, 6) stimulate CT secretion, suggesting that the CT secretory process may be regulated by a multiplicity of factors. Therefore, the purpose of the present study was to examine the influence of exogenously administered PTH on CT secretion in the pig.

Two young male Yorkshire pigs weighing 15-18 kg were used in this study. The animals were fasted overnight before each experiment. Infusion and blood sampling were accomplished by means of an indwelling catheter placed in the internal jugular vein as previously described (3). Blood samples were collected in heparinized tubes and immediately centrifuged, and the plasma was separated and stored at -20 C. Plasma calcium was measured by the automated method of Kessler and Wolfman (7) (Technicon method N-3b).

Calcitonin determinations were performed in duplicate on 100 μl-aliquots of pig plasma using a highly sensitive and specific porcine CT radioimmunoassay which has previously been described (8). Pure porcine CT (Lot # 4688C-140 A, Lederle Laboratories) was used for iodination and as an assay standard. The CT radioimmunoassay was conducted under equilibrium conditions at 4 C. Separation of antibody-bound and free labeled CT was accomplished by adsorption on talc.

A bovine PTH extract (Parathyroid Hormone T.C.A. Fraction, Lot # 144615, Wilson Laboratories) containing 150 PTH units/mg was used for experimental infusions. The extract was dissolved in 5 ml of saline immediately prior to infusion. The total dose of PTH was infused by means of the jugular catheter over a 10-min period.

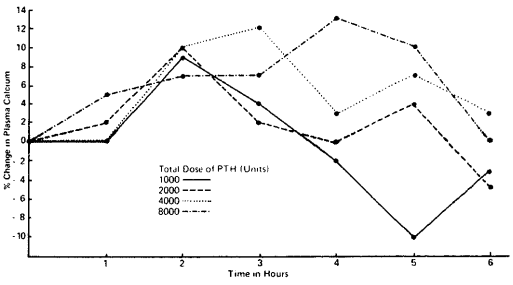

FIGURE 1. Influence of PTH on plasma calcium. Each point represents the per cent change in plasma calcium from a single pig at the time indicated after the PTH infusion, as compared to the plasma calcium concentration in samples taken during a 20-minute period immediately prior to the PTH infusion, which was initiated at time 0. The mean ± S.E.M. of the plasma calcium samples from all four experiments taken prior to the PTH infusion is represented by the shaded horizontal bar.

The effects of various doses of PTH on plasma calcium and CT levels are presented in Figures 1 and 2 respectively. Increasing the total dose of PTH from 1000 to 8000 units produced a greater initial elevation of plasma calcium and CT and a more sustained calcium elevation and CT release. The results of this study indicate a dose-related temporal similarity in the PTH-induced elevation of plasma calcium and CT (Figures 1 and 2). Although the magnitude of change in plasma calcium and CT are not exactly the same at each dosage

level, the total areas under the calcium and CT curves are very similar for each dose of PTH (Table 1).

The results of these experiments do not clearly define the mechanism of the PTH-stimulated CT secretion. However, the elevation in CT secretion observed in the present study may be the result of PTH-induced hypercalcemia. This conclusion is supported by the fact that other methods capable of producing an artificial elevation of plasma calcium (*e.g.*, infusion of calcium salts or large doses of vitamin D) produce an increased secretion of CT, while PTH release is inhibited (1). Further, previous studies indicate that CT secretion is directly related to the level of plasma calcium (4, 5). Whatever the mechanism, the results of the present study clearly demonstrate that PTH administration will produce a parallel increase in circulating levels of calcium and CT in the pig.

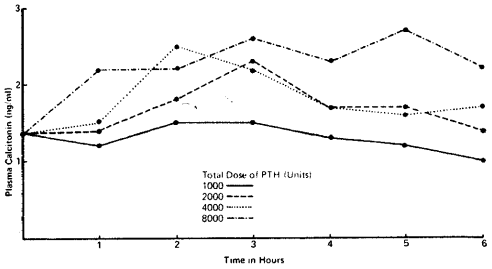

FIGURE 2. Influence of PTH on plasma CT. Each point represents the plasma CT concentration from a single pig at the time indicated after the PTH infusion, which was initiated at time 0. The mean ± S.E.M. of the plasma CT samples from all four experiments taken during a 20-minute period immediately prior to the PTH infusion is represented by the shaded horizontal bar.

TABLE 1. *Cumulative effects of parathyroid hormone on calcium and calcitonin levels in plasma.*

PTH dose (units)	Total area under the curves[a] (cm^2) Calcium	Calcitonin
1000	−0.15	1.78
2000	16.87	17.54
4000	34.62	26.93
8000	43.64	51.18

[a]Total area under the plasma calcium and plasma CT curves in Figures 1 and 2 respectively.

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