

# Effect of acute exposure to cadmium on the expression of calcitonin gene-related peptide (CGRP), calcitonin (CT), somatostatin (SST) and synaptophysin (SYN) in the C cells of the rat thyroid — a preliminary study

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[Received 11 September 2003; Accepted 9 January 2004]

*The aim of the present study was to determine to what degree acute exposure to cadmium affects the expression of CGRP, CT, SST and SYN in the C cells of the rat thyroid. Animals from 7 experimental groups received CdCl<sub>2</sub> iv. in doses of 3.5, 3, 2.5, 2, 1.5, 1 and 0.5 mg/kg b.w. respectively, while the control animals were given 0.9% NaCl iv. 24 hours after the iv. administration of CdCl<sub>2</sub>, a correlation was found between a single dose of cadmium and the intensity of the immunocytochemical reactions for CGRP, CT, SST and SYN in C cells of the rat thyroid when compared to the control. The weakest immunocytochemical reactions were noted in C cells of the thyroid of rats from Groups I and II, their intensity gradually increasing in Groups III, IV and V in comparison to the control. The reaction intensity in animals of Groups VI and VII resembled those of the control.*

**Key words:** rat, thyroid gland, cadmium intoxication

## INTRODUCTION

Cadmium is a trace metal and the endocrine functions of the thyroid are known to be disturbed as a result of acute, subacute and chronic exposure to this element (cadmium is a smoke component). Epidemiological studies carried out among children chronically exposed to cigarette smoke in their households have shown an increase in the level of thyroid-stimulating hormone (TSH) in the blood serum [1]. In experimental subacute exposure of mice to cadmium a decrease was observed in the serum triiodothyroxine level (T3) [2]. Experimental acute exposure to cadmium in rats caused a reduction in the level of T3 and thyroxine (T4) in blood [3]. However, we did not find any data concerning the C cells of the rat

thyroid after acute exposure to cadmium. We therefore decided to evaluate to a what degree acute exposure to cadmium affects the expression of calcitonin gene-related peptide (CGRP), calcitonin (CT), synaptophysin (SYN) and somatostatin (SST) in the C cells of the rat thyroid.

## MATERIAL AND METHODS

48 male Wistar rats were used for the present study. The animals were divided into 8 groups with 6 rats in each group. The animals from 7 experimental groups received CdCl<sub>2</sub> iv. in doses of 3.5, 3, 2.5, 2, 1.5, 1 and 0.5 mg/kg b.w. respectively, while the control animals were given 0.9% NaCl iv. (Table 1). Twenty-four hours after iv. administration of CdCl<sub>2</sub>

**Table 1.** Evaluation of immunohistochemical reaction intensity in thyroid C cells of cadmium treated and untreated rats

Antibody	Control	Group I 3.5 mg Cd/kg b.w.	Group II 3 mg Cd/kg b.w.	Group III 2.5 mg Cd/kg b.w.	Group IV 2 mg Cd/kg b.w.	Group V 1.5 mg Cd/kg b.w.	Group VI 1 mg Cd/kg b.w.	Group VII 0.5 mg Cd/kg b.w.
CT	++++	++	++	+++	+++	+++	++++	++++
SYN	++++	+	+	++	+++	+++	++++	++++
SST	+++c	+c	+	+	+	++	+++c	+++c
CGRP	++++	+	+	++	+++	+++	++++	++++

++++very strong reaction in most cells, +++strong reaction in most cells, +++c— strong reaction in some cells, ++decrease in reaction intensity in most cells, +marked decrease in reaction intensity in most cells, +c — marked decrease in reaction intensity in some cells

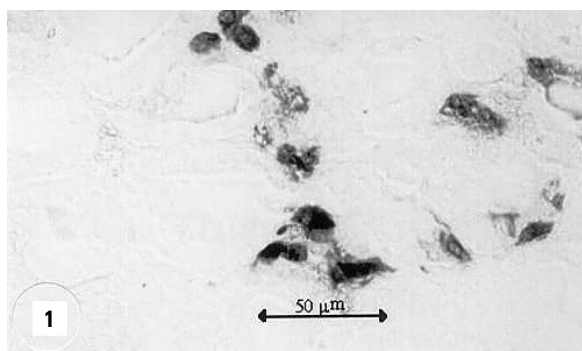
the animals were dissected in anaesthesia with p.o. pentobarbital. Both thyroids were collected for analysis, fixed in Bouin's fluid and processed with the paraffin technique.

Immunocytochemical reactions were performed with the use of antibodies against CGRP, CT, SST and SYN (diluted 1: 8000, 1:50, 1:200, 1: 10, respectively). The reaction product was visualised by a routine ABC technique.

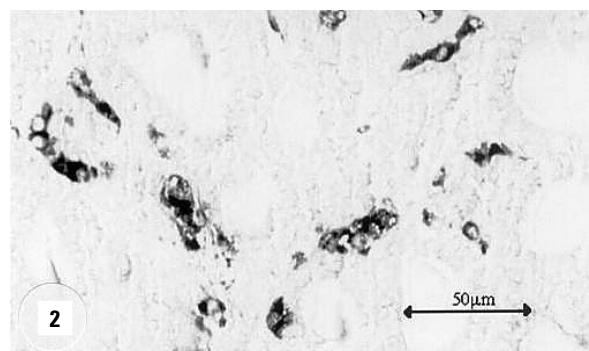
## RESULTS AND DISCUSSION

Intravenous administration of CdCl<sub>2</sub> to rats in a single dose of 3.5, 3, 2.5, 2 and 1.5 mg/kg b.w. caused a decrease in the intensity of the immunocytochemical reactions for CGRP, CT, SST and SYN in the C cells of the rat thyroid, when compared to the control (Table 1). The higher the dose of cadmium, the fewer C cells of the thyroid showed a positive reaction for the peptides studied in comparison to the control tissues, and the reaction intensity was weaker than in the control (Table 1). The weakest immunocytochemical reactions were noted in the thyroid C cells of rats from groups I and II (Fig. 1, 2). In these

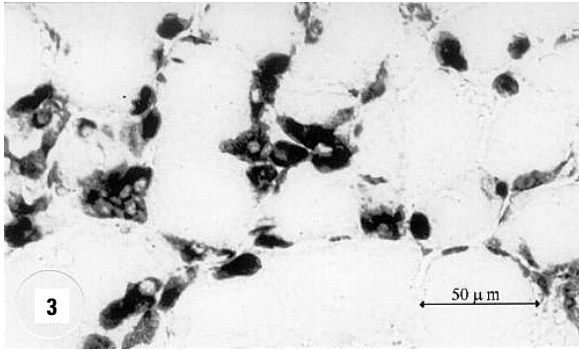
groups, a considerably smaller number of C cells of the thyroid stained for CGRP, CT, SST and SYN and staining intensity was weaker compared to the control (Fig. 1–4). Rats of group III showed slightly increased reactions for CGRP, CT, SST and SYN in thyroid C cells compared to those in Groups I and II (Table 1). More C cells were found in the thyroid with cytoplasmatic staining for CGRP, CT, SST and SYN and the staining was stronger compared to Groups I and II. Immunocytochemical reactions of increased intensity were found in Groups IV and V in comparison to Group III, both in the number of C cells stained positively for CGRP, CT, SYN and SST and in the staining intensity, although the intensity was still weaker than in the control group (Table 1). In C cells of the rat thyroid in Groups VI and VII the reactions for CGRP, CT, SST and SYN were comparable to the control group (Table 1). Our results concerning the attenuation of immunocytochemical reactions for CGRP, CT, SST and SYN in the C cells of rat thyroids after acute exposure to cadmium confirm the reports of other authors who studied these peptides after chronic exposure to cadmium [4]. Our



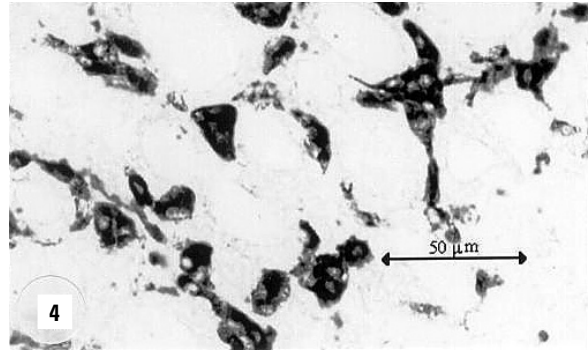
**Figure 1.** Group I. Weaker immunoreactivity for CGRP in some of the C thyroid cells.



**Figure 2.** Group I. Weaker immunoreactivity for SYN in some of the C thyroid cells.



**Figure 3.** Control. Very intense immunoreactivity for CGRP in the cytosol of most of the C thyroid cells.



**Figure 4.** Control. Very intense immunostaining of SYN in the cytosol in most of the C thyroid cells.

experiment seems to indicate that cadmium administered iv. in a single dose of 3.5, 3, 2.5, 2, 1.5 mg/kg b.w. disturbs the functioning of the C cells of the rat thyroid in a dose-dependent manner.

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