Scientific Papers, Animal Science, Series D, vol. LV
CD-ROM ISSN 2285-5769, ISSN-L 2285-5750

THE MANAGEMENT OF CALCIUM BALANCE IN RAT SKELETAL, CARDIAC AND VASCULAR SMOOTH MUSCLE FUNCTION THE ROLE OF CALCITONIN

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Abstract

Aim*:Our study has been concerned with investigation of the effect of Calcitonin treatment upon 45 Ca, 32P and 3H Colesterol uptake by the rat skeletal, vascular and cardiac muscle.*
Material and method*: Animals: 30 white Wistar rats (150-180 g) aged between 6-24 months old divided into two groups of 15 rats each have been taken in our study: 15 young and 15 old. Method: Both, young and old rats have received Calcitonin treatment (vials with 0.5mg/ml = 0.25 mg) 0.025mg have been injected in each animal. Controls have received injections with physiological saline solution. Rats have been killed by cervical dislocation. Muscle fragments have been collected on ice bath ,then weighted and preincubated for one hour at 37^{0}C in Hanks medium pH 7. After one hour, the muscle fragments have been incubated with 45Ca(90µl/ml). In each sample 10µl/sample has been used. Samples have been incubated for 2 hours at 37^{0}C. Nonspecificaly bound radiomarkers have been extracted with 1N Hcl for 24 hours and then a determination of specific bound radioactivity as well as the extracted one using a beta scintillator in liquid phase. 32P has been used with a specific activity of 7 mCi/ml,0.5µCi/sample. 3H Cholesterol has been used also for our experimental studies, with a total activity of 1mCi.0.1mCi/mlhas been used for working solution using 8µl from dilution. The radioactivity has been evaluated with a Beta Betrhold Scintilation Counter.*
Results: *Calcitonin experimentaly administrated has a clear influence upon 45Ca uptake in muscle tissue. Calcitonin treatment has an influence upon 3H Cholesterol uptake in skeletal muscle from treated rats versus controls.*
Conclusions: *Our data have an important clinical value in monitoring calcium level in patients in order to avoid cardiac arithmias and vascular perturbations.*

Key words**:** *calcitonin,skeletal muscle,cardiac muscle, vascular muscle,calcium level,3H cholesterol,45 Calcium*

INTRODUCTION

Hormones are produced by endocrine and neuroendocrine cells and mediate mainly systemic effects Tashjan A.(1970). Cytokines are produced by numerous cell types and mediate local effects. The production of calcitonin (CT) peptides follows either the classical hormonal expression which is believed important for calcium metabolism or cytokinelike expression which is induced by inflammatory stimuli. To describe this plasticity, the term "hormokine" was proposed. The concept is based on the discovery of the ubiquitous expression of CT peptides (i.e., ProCT, CT gene-related peptide (CGRP) and adrenomedullin (ADM)) during sepsis.

Calcitonin (CT) was discovered 40 years ago, when it was assumed to be a hormone with a yet-to-be-determined role in human physiology (Becker KL, et al. 2004). Since then, CT has been found to be only one entity among related circulating peptides which have pivotal roles in the metabolic and inflammatory host response to microbial infections (Becker KL, 2001).

These peptides share marked structural homologies and include procalcitonin (ProCT), calcitonin gene-related peptide (CGRP) I and II, adrenomedullin (ADM), and Amylin. (**Cooper GJ** 1994)

Calcitonin influence in key points in calcium metabolism (**Hay DL, Christopoulos 2005**).

Its administration is important in mentaining Ca levels in normal range(**Jaeger P,Jones et al. 1986**).

The aim of this study was to investigate the mode of action of this molecular agent at the cell membrane level of some unspecialized cells in calcium balance such as muscle tissue.

Our investigations have been done on skeletal, cardiac and aortic muscle tissue from control and treated rat with calcitonin (acute treatment-24 hours).

MATERIAL AND METHOD

Our study has been done on 30 Wistar rats (150-180 g) aged between 6-24 months old: 15 young and 15 old. Both, young and old rats have received Calcitonin treatment (vials with 0.5 mg/ml = 0.25 mg) 0.025 mg have been injected in each animal. Controls have received injections with physiological saline solution. Rats have been killed by cervical dislocation. Muscle fragments have been collected on ice bath, then weighted and preincubated for one hour at 37^{o}C in Hanks medium pH 7. After one hour, the muscle fragments have been incubated with 45Ca (90µl/ml). In each sample 10 µl/sample has been used. Samples have been incubated for 2 hours at 37^{0}C.

Nonspecificaly bound radiomarkers have been extracted with 1N Hcl for 24 hours and then a determination of specific bound radioactivity as well as the exctracted one using a beta scintillator in liquid phase. 32P has been used with a specific activity of 7 mCi/ml, 0.5 µCi/sample. 3H Cholesterol has been used also for our experimental studies, with a total activity of 1mCi.0.1mCi/mlhas been used for working solution using 8 µl from dilution.

The radioactivity has been evaluated with a Beta Betrhold Scintilation Counter.

RESULTS AND DISCUSSIONS

Fig 1 presents the hystogram of 32P uptake in skeletal, cardiac and smooth muscle; a significant increase in 32P uptake in old rats has been recorded versus yong rats.

Fig. 2 Presents the uptake of 45Ca in slkeletal, cardiac and smooth muscle form control and calcitonin treated rats. A decrease in 45Ca uptake in skeletal and cardiac muscle has been recorded in calcitonin treated rats versus controls. No significant difference has been observed for aortic tissue.

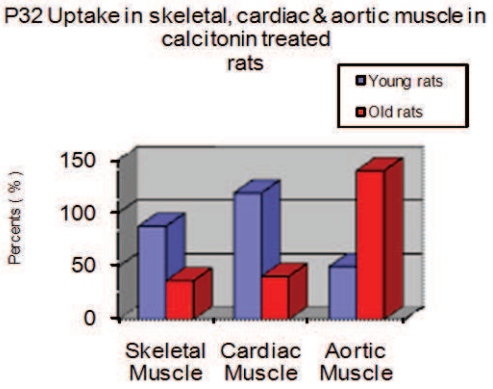

Fig. 1 - ^{32}P uptake in young and old rat skeletal, cardiac and aorta

The different uptake of 45Ca in the three types of muscle can explain somepharmacological aspects which appear in patients treated with calcitonin. Cardiac aritmias which appear after calcitonin injection as well as some vascular disturbances may be the couse in the answer of cell receptors and their influence upon membrane Ca exchange .Receptor binding of calcitonin can be in a direct proportion with the daily dose clinicaly utilised.

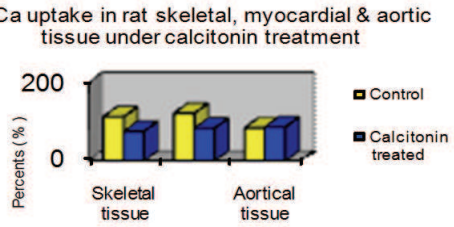

Fig. 2 - ^{45}Ca uptake in rat skeletal, cardiac and aorta from calcitonin treated rats.

Fig. 3 Presents the hystogram of 3H Cholesterol uptake in rat skeletal, myocardial and aortic tissue from cotrol and calcitonin treated rats.

An increase in 3H Cholesterol uptake in skeletal muscle from treated rats has been recorded, in comparison with cardiac and aortic muscle, where a decrease in 3H Cholesterol has been recorded.

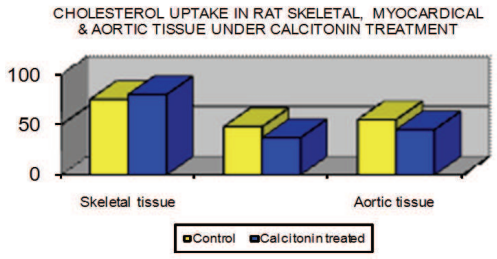

Fig. 3. 3H Cholesterol uptake in skeletal, cardiac and aorta from contol and treated rats with Calcitonin

CONCLUSIONS

Calcitonin experimentaly administrated has a clear influence upon 45Ca uptake in muscle tissue.

Calcitonin treatment has an influence upon 3H Cholesterol uptake in skeletal muscle from treated rats versus controls.

Our data have an important clinical value in monitoring calcium level in patients in order to avoid cardiac arithmias and vascular perturbations.

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