LOW THYROID FUNCTION AND AGEING

The incidence of thyroid disease in elderly patients was previously unrecognized [1]. Since, several publications have demonstrated the high prevalence of subclinical hypothyroidism in elderly subjects. Among several reasons stand the *decreased hypothalamic stimulation* of thyroid function (part of subtle alterations of the hypothalamo-pituitary-thyroid axis) [2] and the increased prevalence of *autoimmune thyroiditis* among these patients [3, 4].

Thyroid auto antibodies affect primarily the two main thyroid proteins, which are thyroglobulin and thyroperoxidase. ***Thyroglobulin*** represents an indispensable scaffold protein enabling thyroid hormonogenesis, but also becomes a storage protein for both thyroid hormones and iodide once the hormones are built [5]. Pituitary TSH controls the thyroid metabolism, while a specific receptor (***TSHR***) is located within the basolateral membrane [6].

Iodide transport across thyrocytes is assumed by two transporters, sodium iodide symporter or ***NIS*** located in the basolateral membrane (facing blood capillaries) and ***pendrin***, a recently discovered protein exchanging iodide and chloride within the apical membrane [7]. Lactating mammary glands also express NIS and ***iodine*** protects breasts against cancer [8].

Thyroperoxidase plays the major role in thyroid hormones biosynthesis, responsible for both the iodination and the coupling of tyrosine residues in thyroglobulin which generate the thyroid hormones T4 (***thyroxine***) with four atoms of iodine and T3 (***triiodothyronine***) with three atoms of iodine [9]. Hydrogen peroxide (***H_2O_2***) produced at the apical pole of thyrocytes [10] plays an essential role in thyroperoxidase activity [11], but also leads to oxidative stress in case of glutathione peroxidase impairment due to ***selenium*** deficiency [12].

Radioactive iodine has been produced by atomic bomb testing (such as the 1951 Buster-Jangler test series in United States of America) and by nuclear accidents (such as the 1986 Tchernobyl accident in Europe). Exactly as therapeutic use of radioactive iodine in case of hyperthyroidism due to Basedow's disease, it can progressively develop hypothyroidism.

Thyroid hormonogenesis may also be impaired by environmental chemicals. Wildlife observations in polluted areas clearly exhibit a significant increase of incidence of goiters and thyroid imbalances [13]. Among most harmful xenobiotics for the thyroid gland are polycyclic aromatic hydrocarbons (**PAHs**) [14], polychlorinated biphenyls (**PCBs**) and **dioxins** [15]. Exposed populations show a significantly higher frequency of thyroid antibodies [16]. Iodine deficiency may aggravate the negative impact of air pollutants on the thyroid metabolism [17].

Thyroxine (T4) can be considered as a prohormone [18], which can be transformed into the much more active triiodothyronine (T3) from a deiodination performed by ***5'-deiodinase***. This reaction doesn't occur in the thyroid gland, but in the periphery, especially in the liver and kidneys. Oppositely, the inactive reverse T3 is produced from T4 by ***5-deiodinase***.

All forms of stress - physiological, pathological and emotional - block the activity of *5'-deiodinase* in favor of *5-deiodinase*, leading to a lack of active T3 and to an excess of inactive reverse T3. Several heavy metals, such as **mercury**, **lead** and **cadmium**, impair the activity of 5'-deiodinase and induce symptoms or clinical signs of hypothyroidism [19, 20].

Interestingly, though the prevalence of thyroid auto antibodies steadily increases throughout the decades, being tightly age-dependant, this phenomenon is not seen after the ninth decade of life [21]. Such observations lead to the concept of "***healthy centenarians***" [21].

107 Rue du Village - 4460 Velroux Belgique - fax : + 32 Ø4 221 52 12 - gsm : + 32 Ø475 60 83 82
gmouton@cybernet.be ou acochet@cybernet.be

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107 Rue du Village - 4460 Velroux Belgique - fax : + 32 Ø4 221 52 12 - gsm : + 32 Ø475 60 83 82
gmouton@cybernet.be ou acochet@cybernet.be