

## **Congenital Hypothyroidism: When the Screening is the Paradigm for Secondary Prevention**

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Congenital hypothyroidism (CH) is one of the most frequent endocrinopathy in childhood [1,2]. It is due to thyroid hormonogenesis defect or abnormality in the thyroid development, leading to ectopic or absent gland. Rarely, CH is due to hypothalamus-pituitary axis defect and may be associated to other pituitary hormones defect. Patients with permanent CH have to take orally daily levo-thyroxine (L-T4) all life-long to avoid the neurological and auxological consequences typically featured by the patients in the pre-screening era.

### **Initial Management**

Confirmatory measurement of blood TSH and fT4 in neonates with positive neonatal screening is mandatory before starting L-T4 administration, without any delay in the start of the treatment. Patients with confirmed CH, hopefully within the 15<sup>th</sup> day of life, do have to be treated with L-T4 immediately. A thyroid scan should be performed at diagnosis or even within the first 5 - 7 days of treatment, as the elevated TSH does not normalize within this period and thus a reliable scan can still be performed. In the patients who do not undergo thyroid scan at diagnosis, it is recommended to perform the scan after the age of 3 years, after 4 weeks of treatment interruption. At this stage no neurological damage occurs in the case of a so long interruption.

The adequacy and the timing of replacing treatment affect both the cognitive and the auxological outcomes. Thyroid hormones levels have to get normal as soon as possible, hopefully within 2 weeks as concerns fT4 and 1 month as concerns TSH [3-6]. Levothyroxine alone, orally given, is recommended as the medication of choice. There is no evidence that combined T4 and T3 therapy is more effective than T4 alone, even if T3 is the most biologically active thyroid hormone. Liquid preparations (drops) should be preferred for the easiness of use. They have been available over the last ten years now and require a shorter time period between administration and food intake than the tablets. On the other hand, the tablets may be crushed and administered via a small spoon, in few drops of water or also milk about 20 - 30 minutes before the feeding. There is no contraindication to breastfeeding, which has to be always encouraged when possible. A starting dose of 10 - 15 µg/kg is recommended, choosing higher dose (13 - 15 µg/kg) for neonates with lower T4. In some patients, fT4 may normalize within few days or even few weeks of treatment, despite TSH remain above the normal range. This is supposed to be the result of fetal hypothyroidism, which "resets" the pituitary-thyroid feedback threshold with likely relative pituitary resistance. In these patients, the LT4 treatment has to be titrated only on fT4 levels. Excessive dose of L-T4 may cause transient hyperthyroidism with adverse clinical effects, such as tachycardia, shortening of sleeping and overall craniosynostosis. In patients with cardiac insufficiency, the starting dose should be reduced by 50% of the target dose and further titrated on the basis of fT4 levels 2 weeks later.

Finally, it is important to remind that 10% of infants with CH have congenital anomalies and that among them, cardiovascular anomalies (atrial or ventricular septal defect, pulmonary stenosis) are the most common [9].

### Follow Up

The L-T4 dose should be titrated according to the clinical condition and the serum fT4 and TSH concentrations. The fT4 levels, rather than the total T4, should periodically be assayed [7], aiming to keep fT4 in the upper half of the reference range, overall during the first 3 years of life when the central nervous system develops, and TSH in the low normal range. The message that the patients do have to take regularly the daily L-T4 dose should be reminded at each visit by the physicians, as in chronic disease treatment adherence plays a key-role. It is well known that low compliance to the treatment, overall during the first years of life, leads to suboptimal serum TSH levels and compromises the neurological and auxological development of these patients. In the case of episodes of TSH above the normal limits, school delay in childhood and a subtle decrease in health related quality of life in young adulthood has been reported. I would like to remind to readers that TSH and thyroid hormones have age-appropriate values, different from those for adults [8], and that T3 dosage may be confusing as normal values for kids are often lacking in local laboratories.

Clinical examination, including assessment of growth and neurological development, should be performed every 1 - 3 months during the first year of life, every 3-6 months on the basis of clinical condition from 1 to 3 years of age, and then less frequently usually 6-monthly or even annually (during adolescence). Serum fT4 and TSH measurements should be assayed at each visit. It is recommended to perform the thyroid function tests more frequently when the adherence to the treatment is suspected to be low and suboptimal values occur. When the daily dose is changed, fT4 and TSH measurements should be repeated no later than 4 weeks.

Growth, puberty, and fertility are normal in patients properly treated [10-12]. Subtle differences in IQ score, school achievement, and neuropsychological tests have been reported in patients with CH as compared to control groups of classmates and siblings [13-16], but these defects do not significantly affect social life. More rarely, selective memory defects, impaired visuospatial processing and sensorimotor defects have been reported. It is still debated whether these differences may be avoided by further optimization of the therapy, but the key-point is that delayed diagnosis, suboptimal treatment and poor compliance to the treatment worsen the prognosis in these patients.

Finally, I would like to remind optimal thyroid hormones for CH women who plan to get pregnant. In this case, an increase of L-T4 dose by 25 - 30% is mandatory as soon as the pregnancy occurs. Pregnant women with TSH out of range present a 4-fold increased risk of miscarriage and their fetuses could have neurological impairment.

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