Hearing dysfunction in Congenitally Hypothyroid Patients

Thesis

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Mohammed Ibrahim Abdul Rahman

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List of Abbreviations

Abbr.	Title
ASRTs	: Acoustic stapedial reflex thresholds
cAMP	: Cyclic adinosine monophosphate
CH	: Congenital hypothyroidism
CHL	: Conductive hearing loss
CNS	: Central nervous system
DNA	: Deoxyribonucleic acid
DPG	: Diphosphoglycerate
DVA	: Dilation of the vestibular aqueduct
ECF	: Extra cellular fluid
EVA	: Enlarged vestibular aqueduct
IQ	: Intelligence quotient
mRNA	: Messenger ribonucleic acid
RIAs	: Radioimmunoassays
RNA	: Ribonucleic acid
RT3	: Reverse triiodothyronine
SNHL	: Sensory neural hearing loss
T3	: Triiodothyronine
T4	: Thyroxine
TBG	: Thyroxine-binding globulin
Tg	: Thyroglobilin
TH	: Thyroid hormone
TR	: Thyroid receptor

TREs : Thyroid hormone response elements

TRH : Thyrotrophin Releasing Hormone

TSH : Thyroid stimulating hormone

UBs : Ultimobronchial bodies

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ABSTRACT

Introduction: An association between thyroid hormone and auditory function has long been recognized in patients with congenital hypothyroidism (CH). Research with laboratory animals has demonstrated that thyroid hormone plays a significant role in the maturation of inner ear structure.

Aim of the Work: To determine the rate of hearing dysfunction in children with congenital hypothyroidism. Also to determine its relation with factors such as congenital hypothyroidism severity and age at starting of treatment.

Patients and Methods: This study was conducted on 30 congenitally hypothyroid patients who were diagnosed by neonatal screening and treated with El-thyroxin, for whom Pure tone audiometry were performed to demonstrate the effect of CH on hearing. Results: there was 10% mild to moderate sensory neural hearing loss (SNHL) detected in the study group.

Conclusion: Sensory neural hearing loss is more common than conductive hearing loss in children with congenital hypothyroidism. Following up of hearing functions in children with congenital hypothyroidism is mandatory. Delayed diagnosis and loss of compliance to treatment contributes to the degree of hearing affection.

Key words: Congenital hypothyroidism, Hearing loss

Introduction

Congenital hypothyroidism (CH) can be defined as a lack of thyroid hormones present from birth which, unless detected and treated early, is associated with irreversible neurological problems and poor growth. Some infants may develop a lack of thyroid hormones after birth and this may represent primary hypothyroidism rather than CH. Children with primary hypothyroidism do not experience the irreversible neurological problems that are seen with untreated CH. The incidence is twice as common in females ***(Park, 2005)***.

All babies are screened at birth "with their mothers' consent" using blood taken via a pinprick and analysed for TSH and T4 ***(Foo, 2002)***.

A high TSH and low T4 confirm the diagnosis ***(Rastogi, 2010)***.

The overall goals of treatment are to assure normal growth and development and psychometric outcome similar to genetic potential, by restoring the serum T4 concentration rapidly to the normal range followed by continued clinical and biochemical euthyroidism ***(Rose, 2006).***

Thyroid hormone is necessary for normal development of the auditory system and the association between thyroid hormone and hearing development has long been recognized in patients with congenital hypothyroidism (CH), endemic

cretinism and thyroid hormone resistance. Recent genetic studies confirmed the relation between thyroid hormone and hearing system development. So, CH, the most common endocrine disorder with an incidence rate of 1/4000-5000 live births also increase the risk of hearing impairment in children ***(Knipper et al., 2001).***

Although mental outcome of CH patients is improved if patients are treated early in infancy, during CH screening, but subtle neurological deficits such as fine motor coordination, attention deficient, speech delay, hearing impairment, and hearing problems may develop. Many studies, both in animal models and human patients have identified auditory system dysfunction among cases with thyroid disorders. Recent reports held after CH screening programs, indicate that mild hearing loss occurs in up to 20% of CH patients ***(Bargagna, 2000).***

Hearing loss, specially its mild form in children may result in delayed speech and difficulties in comprehension and problems in receptive language, auditory processing and reading, which may persist, especially in those with delayed treatment. Therefore, considering the consequences of CH and its related hearing loss and also the fact that CH was more prevalent in our community ***(Hashemipour, 2004)***. The aim of this study was to determine the rate of hearing impairment in CH patients.

Aim of the Work

To determine the rate of hearing dysfunction in children with congenital hypothyroidism and its relation with factors such as severity of the disease and age at starting of treatment.

Embryology of the Thyroid Gland

Development of the Thyroid Gland

The adult thyroid gland in mammals is assembled from two different embryological structures: the thyroid bud and ultimobronchial bodies (UBs). This composite origin reflects the dual endocrine function of the gland. The thyroid bud is derived from the endoderm of the primitive pharynx and will give rise to the Tg-producing follicular cells. The UBs originate from the fourth pharyngeal pouch and contain neural crest-derived cells that will become calcitonin-producing parafollicular cells. These structures migrate from their respective sites of origin, reach their final position in front of the trachea, and fuse to form the definitive thyroid gland. After this early ontogenetic phase, thyroid function begins but remains at a basal level; the later differentiation of the hypothalamic nuclei and the organization of the pituitary-portal vascular system guarantee maturation of thyroid system function ***(Fisher et al., 2009)***.

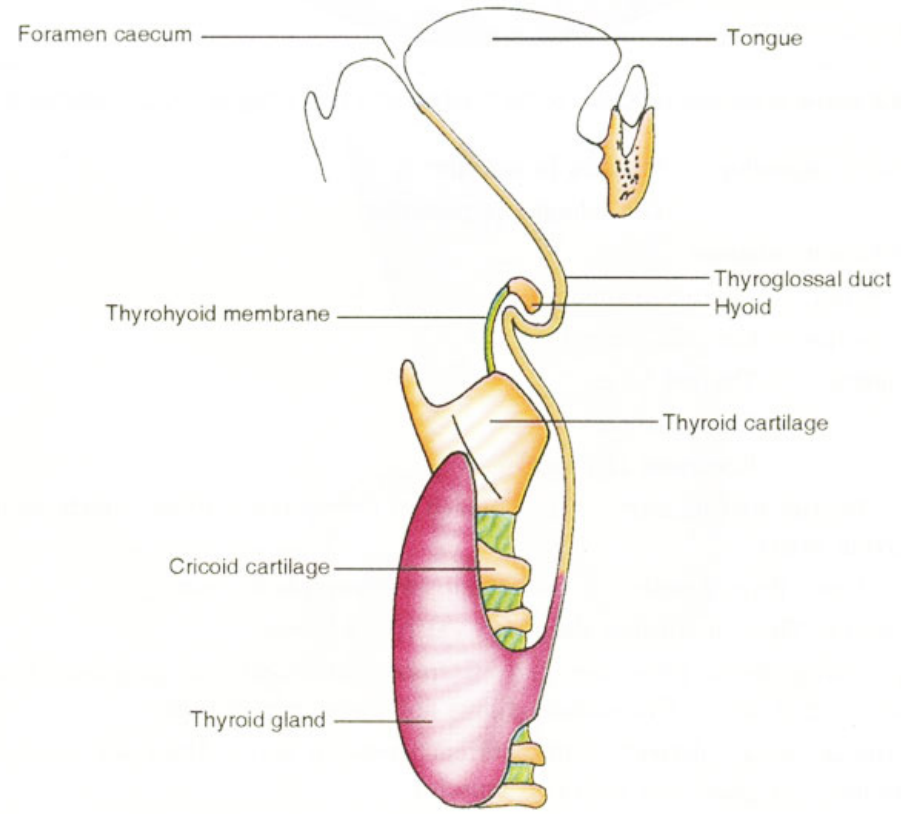

Figure (1): Thyroid gland development ***(Dixit et al., 2009)***

Ontogenesis and Differentiation of the Thyroid Follicular Cell

The thyroid primordium of the human embryo is first visible at 20 to 22 embryonic days as a midline endodermal thickening in the floor of the primitive pharynx, caudal to the origin of the first branchial arch that forms the tuberculum impar. This thickened bud first forms a small endodermal pit and then an outpouching of the endoderm that is in contact with the endothelium of the developing heart. The epithelium of the