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Psychoneuroendocrinology 28 (2003) 304–316

www.elsevier.com/locate/psyneuen

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Thyroid function tests and neurocognitive functioning in children referred for attention deficit/hyperactivity disorder

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Received 13 November 2001; received in revised form 6 March 2002; accepted 8 March 2002

Abstract

Background: Thyroid abnormalities have been associated with attention deficit/hyperactivity disorder (ADHD) and with other childhood psychiatric disorders. The goal of this study was to determine the relationships between thyroid hormone concentrations, neurocognitive functioning, and psychiatric diagnosis in children. **Methods:** Free thyroxine index (FT4I) and thyroid stimulating hormone (TSH) were obtained, along with diagnostic and descriptive information for 338 children referred to a clinic specializing in learning and behavior problems. **Results:** Thyroid abnormalities were uncommon in children referred for ADHD. After excluding children with thyroid disease, there was a greater proportion with low concentrations of normal FT4I for ADHD–Predominantly Inattentive type (ratio=7.0), but not for ADHD–Combined Type. High concentrations of normal FT4I were associated with mood lability, preoccupations, and lower ratings of attention problems. Thyroxine concentrations within the normal range were differentially associated with ADHD–Combined Type compared to ADHD–Predominantly Inattentive, mood disorders, and pervasive developmental disorders. **Conclusion:** Thyroxine concentrations were associated with mood symptoms and unusual behaviors, and were less strongly related to attentional functioning. Thyroxine concentrations were not related to hyperactivity.

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Keywords: Thyroxine; Thyroid hormone; Thyrotropin; Attention deficit hyperactivity disorder

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1. Introduction

It has been known for more than 75 years that thyroid hormones are necessary for normal development: untreated deficiency of thyroid hormones can result in mental retardation (Gordon, 1922). Thyroid dysfunction is common in adults, and is associated with psychiatric symptoms such as emotional instability, lack of energy, slowness, impaired memory, and irritability (Goodman, 1994). Much less is known about the relationship between thyroid abnormalities, neurocognitive functioning, and psychiatric disorders in children.

Children with congenital hypothyroidism have demonstrated neurocognitive and behavioral impairments (Rovet & Alvarez (1996), despite thyroid hormone replacement (Murphy et al., 1990; Rovet et al., 1987). The report of Hauser et al. (1993) showed that in families with resistance to thyroid hormone (RTH), ADHD symptoms were associated with RTH. Although the authors did not claim that all ADHD or “garden variety” ADHD was strongly associated with RTH, this article sparked much interest among clinicians and researchers in the relationship between thyroid function and child psychopathology, as well as controversy (Alessi et al., 1993; Ciaranello, 1993; Stein and Leventhal, 1993). RTH is an inherited disorder characterized by a variable reduction of tissue responsiveness to thyroid hormone (Refetoff et al., 1993). However, over the last five years several prospective studies of thyroid function in children with ADHD have failed to identify a single case of resistance to thyroid hormone (Weiss et al., 1994; Spencer et al., 1995; Valentine et al., 1997). Subsequent studies of individuals with RTH suggest that more severe learning difficulties and cognitive impairments characterize the behavioral phenotype of RTH as compared to ADHD without RTH (Brucker-Davis et al., 1995; Hauser et al., 1998; Stein et al., 1995). However, a recent study suggested that hyperactivity, but not attention symptoms, was associated with increased thyroid hormone concentrations (T4) in children with RTH (Hauser et al., 1997). Since children with the predominately inattentive subtype of ADHD do not display hyperactivity, the Hauser et al. article suggests that ADHD subtypes may be differentially associated with thyroid function.

Thus, several studies of children with RTH, hypothyroidism, and Graves disease suggest that thyroid hormone concentrations are differentially associated with measures of attention and hyperactivity (Alvarez et al., 1983; Brucker-Davis et al., 1995; Stein et al., 1995). Specifically, increased activity has been associated with RTH and with hyperthyroidism, whereas hypothyroidism has been associated with dysphoric mood. It has also been suggested that there is an association between thyroid abnormalities and pervasive developmental disorders (Gillberg et al., 1992). Earlier studies of children with autism or childhood psychoses reported abnormalities in thyroid hormone concentrations (Campbell et al., 1978). However, in a controlled study, autistic children did not display differences in thyroid hormone concentrations when compared to normal children (Cohen et al., 1980).

The goals of the present study were to examine the relationship between thyroid hormone concentrations and ADHD subtypes, and to determine if thyroid hormone concentrations are associated with neurocognitive functioning and psychiatric diagnosis once children with overt thyroid disease are excluded.

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