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Iodine Deficiency — Re-emergence of an old epidemic

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Abstract

Presentation
A 16-year-old boy was referred by the child and adolescent mental health service for assessment of abnormal thyroid function tests.

Diagnosis
He had moderate intellectual disability and autism spectrum disorder. He was asymptomatic in relation to thyroid disorder apart from the presence of a large goitre. He was maintained on a restrictive diet with no gluten or dairy since the age of 2 years following the recommendation of a family friend to help his autistic behaviours.

Treatment
Investigations included thyroid function tests, a thyrotrophin releasing hormone (TRH) test, thyroid ultrasound scan, urine for iodine estimation and serum thyroglobulin measurement which confirmed the diagnosis of iodine deficiency.

Discussion
His thyroid function tests normalised after iodine supplementation, and he is doing well following the introduction of gluten and diary in his diet under skilled dietician input.

Introduction

Restrictive diets are gaining in popularity for a wide variety of conditions in recent years and are often promoted through social media[1]. These diets are often undertaken without professional recommendation or guidance. The treating clinician may be unaware of the dietary restriction and routine dietary history is important to unmask this trend. In those following a restrictive diet, the involvement of a skilled dietician is of paramount importance.

Case report

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A 16-year-old boy with a complex background of autism spectrum disorder (ASD) and moderate intellectual disability was referred to Paediatric Endocrinology from the child and adolescent mental health service (CAMHS) for assessment of abnormal thyroid function tests noted on routine screening prior to initiation of pharmacological treatment for anxiety. He reported no symptoms of thyroid disease such as heat or cold intolerance, fatigue, altered bowel habit, changes in skin or hair. Systemic review was unremarkable. On further questioning, his mother noticed a neck swelling for the past 2 years and could not recall if there was a fluctuation in its size. Birth history: he was delivered by elective caesarean section due to previous caesarean section, at term with a normal birth weight of 3.6 kilograms. He had developmental delay, sitting at 8 months, crawling at 13 months, walking at 18 months, babbling at 18 months and spoke his first words at 2.5 years. Following multidisciplinary assessment, he was diagnosed with ASD, moderate learning disability and both receptive and expressive language delay at 2.8 years by the early intervention team. He is currently in a special school in fourth year with good support from physiotherapy, occupational therapy, and speech therapy. Dietary history: he was bottle fed from birth and experienced problems with food due to sensory issues. He was placed on a restrictive diet by his family; both gluten and diary following a friend's recommendation to help with autistic behaviour. This dietary restriction had never been revisited. There is no family history of thyroid diseases. He lives at home with his family. At presentation he was on no medication. At Initial examination, he measured 180.5cm (75th-90th centile) and weighed 67.8kg (75th-90th centile) with an estimated BMI: 20.81 kg/m2 (50th-75th). Clinically, his heart rate was 80 beats per minute. His blood pressure was difficult to complete satisfactorily despite several attempts due to his anxiety and agitation. He had a large, non-tender smooth, firm goitre with no retrosternal extension, no overlying skin changes, bruit or adenopathy. His Tanner staging G4, P4, A2, TV 15/25. The remainder of his examination was unremarkable.

Initial investigations (Table 1) included thyroid function testing which revealed a low FT4 in the setting of a preserved thyroid stimulating hormone (TSH) concentration and negative anti-thyroid peroxidase antibodies (TPO). Serum FT3 concentrations was the upper part of the reference range. Three morning urinary iodine concentrations were low and serum thyroglobulin was elevated (Table 1). The results of a Thyrotrophin Releasing Hormone test (TRH) are shown in table 2. Ultrasound scan (USS) of the thyroid revealed a diffusely enlarged hypervascular goitre with multiple small benign appearing thyroid nodules about 6mm in size. The radiological interpretation of the thyroid USS was suggestive of thyroiditis.

Table 1: Baseline and Post treatment investigations

Investigations	Baseline	6 months post treatment	11 months post treatment
Thyrotropin stimulating hormone (TSH) (*RR 0.47-3.41)	2.71 mUnits/ml	1.41mUnits/ml	1.32 mUnits/ml
Free Tetraiodothyronine (FT4) (RR 12-22) pmol/ L	5.4 pmol/ L	11.5 pmol/ L	12.8 pmol/ L
Free Triiodothyronine (FT3) (RR 3.9-7.7) pmol/L	7.3 pmol/ L	6.6 pmol/ L	6.4 pmol/ L
Thyroid peroxidase antibodies (TPO) (RR <35 IU/ml)	< 15 IU/ml	<15 IU/ml	<15 IU/ml
Thyroglobulin (RR 16 – 61.3 ng/ml)	1087 ng/ml	352 ng/ml	125.5 ng/ml
Urine iodine (RR 0.39-1.97) umol/L	0.05, 0.06, 0.07 umol/L	0.12 umol/L	0.25 umol/L

Table 2: TRH test.

Test	T 0 minutes	T20 minutes	T60 minutes
TSH (RR 0.47-3.41 mU/L)	3.21 mU/L	52.2 mU/L	29.5 mU/L
FT4 (RR 12-22 pmol/L)	5.3 pmol/ L		
FT3 (RR 3.9-7.7 pmol/L)	7.7 pmol/L		
Prolactin (90-320 mU/L)	193 mU/L	1359 mU/L	534 mU/L

Treatment

Iodine supplementation using a readily available preparation from a health food shop providing 150 micrograms of iodine a day was commenced. He was reviewed by our paediatric dietician and guidance given regarding slow re-introduction of dairy and gluten to the diet.

Outcome and follow up

Repeat thyroid function tests undertaken following 6 months of iodine therapy showed near-restoration of thyroid function tests and complete restoration at 11 months (Table 1). Thyroglubulin concentration improved with near normalisation at 11 months of treatment. Repeat thyroid ultrasound showed bilaterally enlarged thyroid lobes with multiple small nodules, the largest measured 1.3cm. Review at multidisciplinary meeting demonstrated no concerning features. On follow up examination clinically the goitre had reduced in size with no obvious nodularity or adenopathy. An unrestricted diet has been re-introduced without ill effect. General behaviour was reported to have improved with reduced anxiety. However, it is unclear if this was due to the iodine supplementation or due to the Fluoxetine therapy which was commenced simultaneously. The plan is for continued Iodine supplementation until iodine status is replete and for ongoing monitoring until resolution of the goitre with a further thyroid ultrasound at 6 months. It is anticipated that the goitre will resolve when the iodine deficiency has resolved.

Discussion

Iodine is a core component of thyroid hormones, Triiodothyronine (T3), tetraiodothyronine (T4). The chief dietary sources of iodine are dairy products and shellfish.[2] Exclusion diets are a risk factor for Iodine deficiency as demonstrated in this case report. Cheetham et.al. Similarly reported thyroid dysfunction and an iodine deficient goitre in a four-year-old child with multiple food allergies, which resolved within 8 weeks of iodine supplementation.[3] Restrictive diets are gaining in popularity for the treatment of a variety of medical conditions often initiated by families. Many of these diets are promoted by celebrities and promoted by social media. These diets may have adverse consequences particularly in the growing and developing child or young person (CYP). Clinicians should be aware of the popularity of such diets and routinely ask about dietary intake. When a restrictive diet is being followed skilled dietetic input is required to ensure optimal nutrition. Milk is a major source of iodine in the diet particularly for children. However, not all milks are equal. Bath et al found the median iodine concentration of unfortified milk alternatives such as, soya, oat or rice milk was 1.7% that of cow's milk.[4] The use of these milk-alternative drinks is increasing in children and young people with widespread availability in local supermarkets. Unfortified, these milk-alternative drinks could pose a risk of iodine deficiency. The content and type of milk taken should be part of the routine nutrition history. Iodine deficiency has improved globally with introduction of salt iodization in certain countries. There is no such programme currently in Ireland and iodine deficiency is re-emerging in the Irish population. A multi-centre study of iodine status in children aged 8-10 years in the UK (including Northern Ireland) showed that 33% of the cohort had urinary iodine below the cut off level during the summer and 22% below the cut off level during the winter.[5] A cross sectional study of Irish adults showed the majority were

iodine sufficient but 26% were below the estimated Average Requirement (EAR) of iodine in the diet.[6] Further study of childhood iodine status is required in Ireland.

The combination of low iodine status in a proportion of the population in conjunction with the rise of restrictive diets and milk-alternative drinks suggests that clinically important iodine deficiency, thought to be a disease of the past, is likely to become more common in developed countries. This case highlights the dangers of unsupervised restricted diets and the importance of taking a dietary history and re-evaluating the need for dietary restriction in children and young people.

So, in conclusion, restrictive diets are gaining in popularity for a variety of medical conditions often initiated by families. Unsupervised restrictive diets may have adverse consequences particularly in the growing and developing child or young person (CYP). Thyroid Dysfunction and goitre can occur due to iodine deficiency in restricted diets. Clinicians should routinely ask about dietary restriction and use of milk alternatives. Where dietary restriction is required this should be supervised and re-visited.

Declarations of Conflicts of Interest:

None declared.

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