

## Patient report

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# Speech and language delay in two children: an unusual presentation of hyperthyroidism

### Abstract

**Background:** Hyperthyroidism is rare in pre-school children. Untreated, it can have a profound effect on normal growth and development, particularly in the first 2 years of life. Although neurological manifestations of dysthyroid states are well known, specific expressive speech and language disorder as a presentation of hyperthyroidism is rarely documented

**Methods:** Case reports of two children with hyperthyroidism presenting with speech and language delay.

**Results:** We report two pre-school children with hyperthyroidism, who presented with expressive speech and language delay, and demonstrated a significant improvement in their language skills following treatment with anti-thyroid medication.

**Conclusions:** Hyperthyroidism must be considered in all children presenting with speech and language difficulties, particularly expressive speech delay. Prompt recognition and early treatment are likely to improve outcome.

**Keywords:** children; expressive language delay; hyperthyroidism.

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## Introduction

Hyperthyroidism is an uncommon disorder in children and adolescents, and rarely encountered in pre-school children. Most cases are due to Graves' disease where stimulating antibodies target the thyroid stimulating hormone

(TSH) receptor as part of the auto-immune process. The incidence of hyperthyroidism in Europe ranges between 0.7 and 1.83 per 100,000 per year in children <16 years of age (1–4). Thyroid hormone is essential for early neurodevelopment, lack of which can cause defects in neuronal migration and differentiation, gliogenesis, hypomyelination, and synaptogenesis (5). It is well established that a lack of thyroid hormone in a growing foetus and early childhood could lead to a myriad of symptoms and have a significant long-term impact on their behaviour, such as locomotor ability, speech, hearing, and cognition. Excess of thyroid hormone, if left untreated can also have a profound effect on growth and development, particularly in the first 2 years of life (6).

Although neurological manifestations of dysthyroid states are well known, specific speech and language disorder as a presentation of hyperthyroidism is rarely reported in the literature. We describe two children who presented with speech and language delay and were subsequently found to have hyperthyroidism. Both the children demonstrated a significant improvement in their expressive language skills following treatment with anti-thyroid medication.

## Case reports

### Case 1

A 5 year old girl was referred to the paediatric neurology department with concerns about a possible seizure disorder. She was receiving speech and language therapy from 3 years of age as a result of a severe speech disorder and she extensively used non-verbal language for communication. She had a normal hearing test at 4 years of age. At presentation she was unable to put two words together. The rest of her developmental milestones including gross motor, fine motor, vision, and hearing were normal. There was no family history of thyroid disorders. She had a subtle goitre on examination but was not thought to have

overt signs of thyrotoxicosis. Her weight and height was on 91st and 99th percentile, respectively.

Investigations revealed markedly raised free T4 (58.5 pmol/L; normal value <25 pmol/L), suppressed TSH (TSH <0.05 mIU/L; normal range 0.36–4.6 mIU/L) and positive thyrotropin stimulating hormone receptor antibodies (3 U/L; normal value <1 U/L) in keeping with Graves' disease.

A formal speech and language assessment was carried out that confirmed severe speech and language delay with an inability to form even short sentences, delayed speech sound production, difficulty in planning word execution along with sub-normal receptive language. She was commenced on Carbimazole and had repeat speech and language assessment after 6 months of treatment. She showed considerable improvement in attention and concentration and was able to engage in learning. Her speech improved and she was able to form sentences with some impairment in producing speech sounds after 6 months of treatment. She continued to have problems in planning and processing speech at follow-up, however, this was significantly better than prior to treatment. The details of the assessment are outlined in Table 1.

## Case 2

A 3.5 year old boy was referred to the endocrinology department for possible hyperthyroidism in view of speech delay and bilateral proptosis. He had signs of thyrotoxicosis on presentation with poor attention span, heat intolerance, hyperdynamic circulation, resting tachycardia, palpable goitre, and bilateral orbitopathy. His weight was on the 91st percentile with a corresponding height between 50th and 75th percentiles. There was a strong family history of hyperthyroidism on the paternal side of the family. He was receiving speech and language therapy from the age of 2 years as a result of speech and language delay. Investigations revealed elevated free T4 concentrations (112 pmol/L), suppressed TSH (<0.05 mIU/L) with raised levels of thyrotropin stimulating hormone receptor antibodies (60 U/L) in keeping with Graves' disease.

He underwent a formal speech and language assessment prior to treatment that demonstrated poor attention and concentration, and severely affected auditory memory. He had significant expressive speech delay and had difficulty word finding, issues with speech sound production, and consonant substitution. He was commenced on Carbimazole and a  $\beta$ -blocker; he was reassessed by the speech therapists after 6 months of treatment. Following treatment he had a noticeable improvement in

his attention and concentration. His expressive speech improved, however, he continues to have word finding difficulties at 6 months following treatment. The details of the assessment are outlined in Table 1.

## Discussion

Graves' disease is the most common cause of thyrotoxicosis in children. The incidence of Graves' disease progressively increases through childhood with a peak incidence in children between 11 and 15 years of age (1). Graves' disease in pre-school children is rare, but there have been case reports of children as young as 18 months with autoimmune thyroid hormone excess in the literature (7). Untreated, thyrotoxicosis can cause failure to thrive and significant problems with growth and development (7, 8). Mild to severe psychomotor delay has been described in a few children with thyrotoxicosis diagnosed in infancy (9, 10). Transient speech impairment in hyperthyroidism has been reported, however, this is not a well-recognised presentation (11, 12).

We describe two children who were presented to us with speech and language delay, and were found to have thyrotoxicosis on routine biochemical investigation. We believe that the speech and language delay was a direct consequence of the excess thyroid hormone even though one of our cases did not have profound signs of thyrotoxicosis. To our knowledge, there are very few cases in the literature of children presenting to clinicians with speech and language delay who were found to be thyrotoxic. Suresh et al. described a 2 year old child who presented with poor language development and hyperkinetic behaviour (13). The child's speech was restricted to two words, however, he had good receptive language. This patient was also clinically euthyroid with no signs of goitre, exophthalmos or any other systemic features of thyrotoxicosis. He was found to be thyrotoxic and following treatment he showed improvement in his language development (13).

Segni et al. have described three pre-school aged children with Grave's disease along with unusual features such as hyperactivity, emotional lability, 'nervousness', sleep disorder, and expressive language delay (6). One of the three children also had gross motor delay along with poor language skills. Following treatment, two children showed significant development of their language skills and were found age appropriate for these skills at follow up (6). Similarly, both of our children demonstrated significant improvement in their speech and language skills at 6 months following treatment with anti-thyroid

Table 1 Detailed speech and language assessment of both cases.

|   | Pre-treatment  | Post-treatment  |  |
|---|--|---|--|
|   |  | 6 months  | 12 months  |
| Case 1  |  |   |  |
| Attention and listening skills  | Poor for age   | Slight improvement<br>Engaging better with learning   | Significant improvement in attentiveness   |
| Receptive language and comprehension<br>(Preschool clinical evaluation of language fundamentals (2nd. Ed);<br>(Assessment of comprehension and expression 6–11) | Difficult to assess due to poor attention and listening skills.<br>Understood simple 2-step commands   | Some improvement<br>Difficulty in recalling longer instructions (likely due to attention skills)  | Continued improvement  |
| Expressive language<br>(Preschool clinical evaluation of language fundamentals (2nd. Ed);<br>(Assessment of comprehension and expression 6–11)                  | Difficulties word planning and execution<br>Issues with naming and word classes  | Improvements noted; especially with naming and sentence formation<br>Continued problems with speech planning  | Continued improvement; particularly in word planning                                   |
| Speech (articulation and phonology)<br>(Diagnostic evaluation of articulation and phonology)  | Very poor articulation of speech sounds; omitted consonants  | Slight improvement; but continues to struggle with speech sounds, especially longer words   | Significant improvement in speech sound production                                     |
| Case 2  |  |   |  |
| Attention and listening skills  | Poor for age; unruly behaviour on given task<br>Struggled basic grammatical concepts: 'big/small, lowest/highest, first/middle/last'<br>Poor auditory memory | Slow improvement<br>Much better attention span<br>Some improvement. Difficulty recalling longer instructions<br>Struggling with 'middle and furthest' | Continued improvement<br>Slow improvement; but similar difficulties                    |
| Receptive language and comprehension<br>(Derbyshire language scheme detailed test of comprehension; Boehm Test of basic concepts)                               | Long strings of jargon interspersed with real words; 3–4 word utterances<br>Delayed expressive vocabulary use<br>Finding difficulties; omitted consonants    | Particular difficulties in areas of word knowledge/use and topic maintenance  | Minor expressive language immaturities<br>Communication skills progress steadily       |
| Expressive language<br>(Renfrew word finding test)  | Poor oro-motor skills<br>Poor articulation of speech sounds, frequently during eating and speaking   | Slow progress with speech sounds<br>Difficulties with multisyllabic words   | Improved articulation<br>Speech within average range for age<br>Slight residual errors |
| Speech (articulation and phonology)<br>(Renfrew word finding test)  |  |   |  |

medication. Both of our patients were receiving speech and language therapy prior to diagnosis of hyperthyroidism, but did not show any improvement in their language skills. The fact that they improved dramatically after anti-thyroid treatment leads us to believe that underlying hyperthyroidism was the likely cause of their speech and language delay, rather than being an 'epiphenomenon'. It is noted that both of the children we describe do not appear to have 'caught up' in terms of expected level of educational attainment. This is likely to reflect the fact that there was impaired new learning and memory throughout the illness, and as the developing brain is more vulnerable to any disorder that impacts upon cognitive function.

These cases highlight the importance of investigating children for thyroid disorders who present with speech and language delay. Hypothyroidism is well known to cause

psychomotor delay, but paediatricians must be aware of expressive speech delay as a consequence of thyrotoxicosis. Clinical signs and family history of a thyroid disorder should be considered on first presentation of speech and language delay, and a more aggressive approach applied towards investigating it if the child is not responding to traditional speech and language therapy. It is also important to recognise this consequence, as early diagnosis and prompt treatment may reduce any developmental impact by improving speech and language as demonstrated in our cases. We recommend that thyroid function testing must be undertaken in all children presenting with expressive speech delay in isolation or with psychomotor delay.

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## References

1. Williamson S, Greene SA. Incidence of thyrotoxicosis in childhood: a national population based study in the UK and Ireland. *Clin Endocrinol (Oxf)* 2010;72:358–63.
2. Forsberg M, Arvidsson CG, Engvall J, Lindblad C, Snellman K, et al. Increasing incidence of childhood thyrotoxicosis in a population-based area of central Sweden. *Acta Paediatr* 2004;93:25–9.
3. Kumorowicz-Kopiec M, Dziatkowiak H, Starzyk J, Nizankowska-Błaz T, Rybakowa M. (Incidence of Graves' disease in children in some regions of southeastern Poland). *Przegl Lek* 2004;61:872–5.
4. Lavard L, Ranløv I, Perrild H, Andersen O, Jacobsen BB. Incidence of juvenile thyrotoxicosis in Denmark, 1982–1988. A nationwide study. *Eur J Endocrinol* 1994;130:565–8.
5. Howdeshell KL. A model of the development of the brain as a construct of the thyroid system. *Environ Health Perspect* 2002;110:337–48.
6. Segni M, Leonardi E, Mazzoncini B, Pucarelli I, Pasquino AM. Special features of Graves' disease in early childhood. *Thyroid* 1999;9:871–7.
7. Park RW, Frasier SD. Hyperthyroidism under 2 years of age. *Am J Dis Child* 1970;120:157–9.
8. Robinson DC, Hall R, Munro DS. Graves's disease, an unusual complication: raised intracranial pressure due to premature fusion of skull sutures. *Arch Dis Child* 1969;44:252–7.
9. Kopelman AE. Delayed cerebral development in twins with congenital hyperthyroidism. *Am J Dis Child* 1983;137:842–5.
10. Daneman D, Howard NJ. Neonatal thyrotoxicosis: intellectual impairment and craniosynostosis in later years *J Pediatr* 1980;97:257–9.
11. Crile G Jr, Blanton LJ. Exophthalmic goiter in a boy two and one-half years of age. *Am J Dis Child* 1937;53:1039–46.
12. Altman LD. Juvenile thyrotoxicosis treated with propyl thiouracil and two subtotal thyroidectomies. *J Pediatr* 1950;36:244–6.
13. Suresh PA, Sebastian S, George A, Radhakrishnan K. Subclinical hyperthyroidism and hyperkinetic behavior in children. *Pediatr Neurol* 1999;20:192–4.