T3 Toxicosis – a case report

by *V. Mahadev*
MB MRCP MSc AM,
Physician,
Institute of Radiotherapy & Nuclear Medicine,
Hospital Besar,
Kuala Lumpur.

and *Loh Gee Woo*
BSC Hons,
Biochemist,
Institute of Radiotherapy & Nuclear Medicine,
Hospital Besar,
Kuala Lumpur.

Ng Tian Seng
MB MRCP MRACP,
Physician,
District Hospital,
Kuala Pilah.

Introduction

TRIIODOTHYRONINE (T3) THYROTOXICOSIS has been accepted as a distinct variant of thyrotoxicosis in adults since it was first documented by Hollander et al in 1971. Patients with Graves disease, autonomous hyperfunctioning adenomas, or multinodular toxic goiter may present with hypertriiodothyronemia without elevation of serum thyroxine (T4) levels. Although serum thyroxine levels are normally 50 times higher than serum triiodothyronine (T3) the latter is 3 to 4 times as potent biologically with a free T3 fraction 1/7 that of free T4. T3 has a direct biological action independant of T4. A compensatory elevation of T3 may occur in subclinical hypothyroidism (Evered 1973), endemic goiter (Kochipillai 1973) and Pendreds syndrome (Gomez-pan 1974). High T3 levels in the presence of a normal T4 may occur as a precursor of relapse of hyperthyroidism (Hollander 1971), in opthalmic Graves disease (Ormston 1973) and in autonomous thyroid nodules (Evered 1973). The criteria for the diagnosis of so called T3 toxicosis are (1) clinical hyperthyroidism. (2) normal serum total T4. (3) normal free T4. (4) normal or increased radioactive iodine uptake which cannot be suppressed by adequate doses of T3. (5) increased total T3. (6) normal TBG.

Case report

The patient, a housewife (Z bte A.R.) was first seen in Hospital Daerah Kuala Pilah on 19.9.1973 with a history of chest pain on the left side more on breathing. However this history was changed to that of left loin pain while patient was in the ward and the patient was diagnosed on discharge as urinary tract infection and later readmitted for I.V.P. The I.V.P. was normal. The E.C.G. on 19.9.1973 showed a sinus tachycardia of about 100/minute. Chest X'Ray was normal.

On 12.6.1974 she was readmitted with right sided chest pain and she was diagnosed as bronchitis on discharge. Chest x-ray was normal but the E.C.G. still recorded a tachycardia of 100/minute.

She was admitted again on 9.9.1974 again complaining of chest pain and a pericardial rub was heard at this stage. E.C.G. on 11.9.1974 showed a trial fibrillation with a rapid ventricular response but no evidence of pericarditis is seen. Chest x-ray showed an enlarged heart. She was given digoxin and Eraldin (practolol) and Lasix. On discharge she had sinus rhythmn but the rate was still 100/minute.

She was seen by one of us (N.T.S.) on 31.5.1975. This time she again had left sided chest pain. On further questioning she admitted that she felt palpitations in the left side of the chest off and on and this gives her a distinct discomfort but there was no relation to exertion. Direct questions showed that she had weakness in the girdle muscles; had normal bowel habits and felt warm most of the time. She did not feel cold in the early hours of the morning. She had a normal appetite and did not lose weight recently. Clinical examination revealed a thin lady in no obvious distress but with difficulty in getting up from the squatting position. There were no eye signs of thyrotoxicosis. The thyroid was clinically enlarged but there was no bruit. The hands showed only minimal tremor

and was warm and wet. The resting pulse was 100/minute regular with BP 150/90. The heart was not enlarged but there was a soft systolic ejection murmur at the left sternal edge. E.C.G. again showed a sinus tachycardia of 100/minute. A tentative diagnosis of thyrotoxicosis was made. The sleeping pulse was 80/minute, and on reviewing the history the inescapable facts emerged that here was a woman of 50 with a tachycardia and an enlarged thyroid gland and has been complaining of palpitation for almost two years; a study of the thyroid function was clearly indicated.

20 Microcuries of I^{131} was given orally for uptake on 30.7.1975.
4 hour uptake 60%
24 hour retention 78%
T3 – RU 88%
T4 – ETR 1.03
Serum T4 level 11.3 Ug %
Raised uptake & retention; normal RU, ETR, & T4
Scan – slightly enlarged thyroid gland
Comment – Enthyroid
However radioimmunoassay of T3 was done and the level of T3 was 4.8 nanogram/ml. and a diagnosis of T3 toxicosis was made.

The patient was treated with carbimazole and after two months she was clinically much improved and a repeat T3 value was 2.6ng/ml.

Discussion

The mean value of serum T3 measured by radioimmunoassay in normal subjects has been reported as being between 1 and 2 ng/ml the actual value depending on the particular laboratory. The T3 estimation was done using an RIA kit from Radiochemical centre, Amersham.

	Normal values	Patient on 30/7/75
Total serum T4 (mcg %)	4 – 12 mcg%	11.3 mcg%
UTBG index (%)	75 – 112%	88%
Effective Thyroxine Ratio	0.82 – 1.16	1.03
Free Thyroxine Index	5.3 – 12.5	12.5
Serum Triiodothyronine (ng/ml)		
(female non pregnant)	0.66 – 1.86 ng/ml	4.8 ng/ml.
Ratio of T4:T3	70:1	23:1

Table 1

Summary of in vitrio thyroid levels in normals and patient

Hypertriiodothyroniemia may be a premonitary manifestation of thyrotoxicosis (Hollander 1971). However in this lady the symptoms of thyrotoxicosis could be noted from September 1973 almost 2 years before the diagnosis was made. The predominant cardiac presentation of this patient with hardly any other features of thyrotoxicosis is noteworthy. A pericardial rub was heard and this is due to a scratching systolic sound along the left sternal border which is often mistaken for a rub in cases of thyrotoxicosis. There was no other evidence of a pericarditis. Eye signs were significantly absent in this case although there is some evidence for a correlation between triiodothyronine (T3) and eye involvement. All the criteria for T3 toxicosis namely clinical hyperthyroidism, normal total T4, normal free T4, increased radiactive iodine uptake, increased total T3 and normal UTBG are fullfilled. The serum T3 concentration is usually increased in all cases of thyrotoxicosis but in T3 toxicosis the magnitude of this discrepancy is greatly exaggerated. The elevated serum T3 possibily arises not from peripheral conversion of T4 to T3 but from the predominant hypersecretion of T3 relative to T4. In support of this view is the finding that hyperfunctioning thyroid nodules a relatively common cause of T3 toxicosis frequently contain an abnormally high T3: T4 ratio in their thyroglobulin.

The presence of T3 toxicosis is common in patients after 131 I therapy and surgery. In the case described there was no prior therapy of relevance. T3 toxicosis among hyperthyroid patients in New York was reported as 4% (Hollander, 1972) and a similar figure was reported from Canada (Tremblay, 1972). In this area T3 toxicosis was reported as a rarity in Singapore (Tan BY er al., 1975) and most of their cases were those with relapse following 1311 therapy or surgery. In Kuala Lumpur at the department of Nuclear Medicine at least 3 cases have been seen in a survey of over 200 cases of thyrotoxicosis examined. However hypertriiodothyronemia in association with normal or reduced T4 levels appear to be extremely common after 131^{I} therapy for thyrotoxicosis (Mahadev et al., 1975).

With more widespread availability of RIA T3 estimation more exact information on the incidence of T3 toxicosis in this area will be available soon but current evidence suggests an incidence of 1% or less. It is well known that elevated T3 levels may precede the development of over† hyperthyroidism and elevation of T4 values. It is likely that patients are examined at a more late stage of their disease here than in more advanced countries accounting for the relative rarity of T3 toxicosis. The incidence of T3 toxicosis appears to be also correlated with dietary iodine. Thus a high inci-

dence of 12.5% was reported from an iodine deficient area in Chile (Hollander, 1972). The low apparent incidence of T3 toxicosis in this area may well be a consequence of high dietary iodine.

Summary and comments

This is a report of a 50 year old housewife who had a number of admissions for palpitations and one episode of paroxysmal atrial fibrillation for which a cause was not looked for but when thyroid enlargement was noted the pieces fell in place. It is seen that T3 toxicosis in middle life also gives rise to symptoms referable to the heart. T3 toxicosis is perhaps a rare form of thyrotoxicosis in this area but it has to be kept in mind in all cases with clinical features of thyrotoxicosis and normal T4 values.

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