

Evaluation of thyroid stimulating hormone (TSH) alone as a first-line thyroid function test (TFT) in Papua New Guinea

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SUMMARY

In the Port Moresby General Hospital, the Chemical Pathology Department assays both thyroid stimulating hormone (TSH) and free thyroxine (FT4) on all requests for a thyroid function test (TFT). The cost of assaying both tests is obviously higher than either test alone. In order to minimize the cost of a TFT we aimed to determine if TSH or FT4 alone as a first-line test would be adequate in assessing the thyroid hormone status of patients. We analyzed TFT records from January 1996 to May 2000 in the Port Moresby General Hospital. A total of 3089 TSH and 2867 FT4 were assayed at an annual reagent cost of Papua New Guinea kina 14,500. When TSH alone is used as a first-line test at the Port Moresby General Hospital, the biochemical status of 95% of patients will be appropriately categorized as euthyroidism, hypothyroidism or hyperthyroidism with only 5% discrepant (ie, normal TSH with abnormal FT4) results. In contrast, using FT4 alone as a first-line test correctly classifies only 84% of TFTs. Euthyroid status is observed in 50% of patients and FT4 assays on these samples will be excluded appropriately if a TSH-only protocol is adopted. Furthermore, we will save a quarter of the yearly cost of TFTs on reagents alone by performing TSH only. We conclude that TSH alone is an adequate first-line thyroid function test in Papua New Guinea and when it is normal no further FT4 test is necessary unless clinically indicated.

Introduction

Thyroid stimulating hormone (TSH) and free thyroxine (FT4) requests are the usual first-line tests to assess thyroid status. They are commonly performed simultaneously for the assessment of thyroid disease before any additional investigation (1,2). Since commencing thyroid hormone testing in 1989 in the Port Moresby General Hospital (PMGH), we have been performing both TSH and FT4 together initially to screen for thyroid dysfunction. Although most of the samples are from clinics around Port Moresby city, we also test samples received from all parts of Papua New Guinea (PNG). In order to minimize cost we performed a retrospective thyroid function test (TFT) data analysis to determine if either TSH or FT4 alone is sufficient for assessing thyroid hormone status.

Methods and Materials

We analyzed records of TFTs performed in

the PMGH pathology laboratory between January 1996 and May 2000. The TSH and FT4 assays are performed by the microparticle immunoassay technique (ABBOTT IMX) using hormone-specific antibodies. The laboratory uses the following reference ranges: TSH 0.3-5.0 mU/l and FT4 9-25 pmol/l. The requests for TFTs come from clinically suspected patients from the outpatient as well as inpatient departments. The records kept manually include the patient's name, address, approximate age or date of birth (if known), clinical information and names of the requesting doctor and ward or hospital. We determined the percentage of patients with normal TSH with abnormal FT4, and abnormal TSH with normal FT4. We also estimated the potential savings on the annual cost of TFT reagents if the single-test protocol was adopted. In addition, the percentages of patients with various thyroid hormone patterns (euthyroidism, hyperthyroidism and hypothyroidism) were also calculated (Table 1).

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TABLE 1

THE DISTRIBUTION OF THYROID HORMONE STATUS IN THE PORT MORESBY GENERAL HOSPITAL CHEMICAL PATHOLOGY LABORATORY BETWEEN JANUARY 1996 AND MAY 2000

	Low	TSH Normal	High
FT4 High	620 (22.4%) hyperthyroidism	55 (2.0%)	31 (1.1%) hyperthyroidism
Normal	212 (7.7%)	1378 (49.8%) euthyroidism	238 (8.6%)
Low	31 (1.1%) hypothyroidism	90 (3.3%)	113 (4.1%) hypothyroidism

N = 2768; 420 samples were omitted because they had only TSH or FT4 assayed and not both
TSH = thyroid stimulating hormone
FT4 = free thyroxine

Results

A total of 3188 blood TFT requests were assayed between January 1996 and May 2000: 2768 samples had both TSH and FT4 performed while 420 samples had only TSH (n=321) or FT4 (n=99) assayed. The total TSH assayed over the 4 years and 5 months period was 3089 (699/year) while FT4 was 2867 (649/year). In 5% of TFTs, there was normal TSH despite the presence of abnormal FT4 and by performing TSH only as a first-line test, these would have been missed. In contrast, when FT4 was assessed as an initial test, 16% of thyroid function tests had normal FT4 in the presence of abnormal TSH.

The estimated reagent cost for performing an individual test is K10.36 for TSH and K11.17 for FT4. Hence, the total annual TFT reagent cost is around K14,490, which includes K7240 for TSH and K7250 for FT4 assays. If a TSH-only protocol is adopted, 50% of samples will require no additional FT4 testing since the results of TSH will be normal, resulting in 50% savings on FT4 reagent or 25% off the total TFT reagent costs annually.

Table 1 shows the distribution of thyroid hormone status as euthyroid, hyperthyroid or hypothyroid results. Euthyroid pattern is seen in half of the TFT requests while the other half shows abnormal thyroid hormone status suggesting either thyroid disease or

nonthyroidal illness. In only 79% of TFTs was the TSH and FT4 relationship concordant (ie, normal TSH with normal FT4 in euthyroidism, high or low TSH with low FT4 in hypothyroidism and low or high TSH with high FT4 in hyperthyroidism). However, the classical patterns of hyperthyroidism (low TSH with high FT4) and hypothyroidism (high TSH with low FT4) were only observed in 22% and 4% of the total tests, respectively.

Discussion

In this retrospective analysis of TFTs performed at the PMGH pathology laboratory, we have shown that TSH alone is adequate as an initial test for thyroid disease. Only patients with an abnormal TSH report will require additional tests such as FT4 and FT3. However, about 5% of bloods will have abnormal FT4 results despite having normal TSH and by testing TSH only initially these will be missed. Those missed by TSH testing will include patients with known thyroid disease on treatment or sick-euthyroid syndrome or those on drugs known to interfere with thyroid hormone levels. Only a small percentage of patients with true thyroid disease will be included in the 5% discordant results. In PNG where many patients present with full-blown clinical features of thyroid disease, it is unlikely that patients with significant thyroid dysfunction will be missed by assaying TSH alone since diagnosis will be clearly evident

from clinical and laboratory tests. However, in those patients with normal TSH despite strong clinical features of thyroid disease, further FT4 and FT3 tests can be requested after discussing with the laboratory staff.

After all, TSH and FT4 results are not absolute and abnormal results do not necessarily imply thyroid disease nor do normal results imply euthyroidism. The complete diagnosis of thyroid dysfunction is based not only on a laboratory 'number' but also on clinical findings since TFT results can be affected by both pre-analytical (stress) and analytical (heterophile antibodies) factors. In general, a TFT should not be performed in acutely ill patients without clinical signs of thyroid disease until they are clinically stable (2). Nonetheless, according to our finding, an estimated 90% of the TFTs with normal TSH will not require further testing. This finding is not unexpected and is consistent with recommendations to use TSH only as a first-line test for thyroid function testing (1,2), particularly in a general population. While we advocate TSH-only as a first-line thyroid function test in our population, in individuals with established thyroid disease, simultaneous request for TSH and FT4 is valid until hormone levels are stabilized by treatment. Similarly, TSH alone is not a good indicator of thyroid hormone status in monitoring patients with thyroid disease secondary to pituitary or hypothalamic disease and FT4 should also be measured in these patients.

Apart from secondary thyroid disease, FT4 alone should not be used initially to assess thyroid disease since 16% of patients with an abnormal TFT are missed. Approximately 50% of FT4 requests will not be assayed if the TSH-only protocol is adopted because in these

requests the initial TSH result will be normal. In using TSH only, the laboratory will save around 25% on annual reagent costs (K4000) since FT4 assays currently account for half the cost of TFT reagent yearly.

The blood TSH and FT4 patterns are not indicative of the true distribution of various thyroid disease states in patients since we do not know the full clinical history of every patient. However, it was not the aim of this study to relate laboratory results to clinical findings. Furthermore, a possible bias may have been introduced in the study by the inclusion of data from one patient measured on multiple occasions. While the specificities, sensitivities and predictive values would have been affected, we believe the overall trends and conclusions are still valid. However, care should be taken in interpreting TFT reports since in 21% of results the TSH and FT4 relationships are inappropriate, ie do not show euthyroid, hypothyroid or hyperthyroid features. In order to avoid incorrect diagnosis, we suggest close consultation with physicians or pathologists so that further testing can be considered on samples with an inappropriate TSH and FT4 pattern.

Conclusion

TSH testing alone is adequate in 95% of TFT requests and reduces the cost of TFT reagent by 25%. Unless clinically indicated, no further testing is required if TSH is normal.

REFERENCES

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