adenomas (which commonly expand the pituitary fossa before or soon after the onset of visual symptoms), however, the use of skull radiographs earlier would probably have hastened the correct diagnosis in most patients.

Conclusions

The main reason for errors in the diagnosis of optic nerve or chiasmal compression in patients presenting with unilateral failing vision is failure to think of the condition. Omitting to chart the visual fields, lack of regular ophthalmological follow-up in patients in whom an unequivocal diagnosis could not be made initially, and infrequent use of skull radiographs all contributed to this failure.

Despite the rarity of compressing lesions and the variation in their mode of presentation we believe that most errors in diagnosis could be avoided if the following points were always considered: (a) the diagnosis of a compressing lesion should be entertained whenever unilateral failing vision does not have an unequivocally demonstrable intraocular cause; (b) a diagnosis of retrolubar or optic neuritis should not be accepted without the essential criteria followed by the usual course of this con-

dition; (c) the visual fields should be charted early and repeatedly; (d) patients in whom a firm diagnosis cannot be made at the first consultation should be carefully followed up; (e) plain skull radiographs should be requested in those patients in whom a firm diagnosis cannot be made and in those in whom a compressing lesion is suspected.

We thank our neurological and neurosurgical colleagues of the Wessex Neurological Centre for permission to report patients admitted under their care and Dr. Peter Robinson for advice in the preparation of this paper.

References

- ¹ Jane, J. A., and McKissock, W., *British Medical Journal*, 1962, 2, 5.
- ² Meadows, S. P., *Proceedings of the Royal Society of Medicine*, 1949, 42, 1017.
- ³ Clover, P., *Proceedings of the Royal Society of Medicine*, 1961, 54, 616.
- ⁴ Pruett, R. C., and Wepsic, J. G., *American Journal of Ophthalmology*, 1973, 76, 229.
- ⁵ Elkington, S. G., *British Journal of Ophthalmology*, 1968, 52, 322.
- ⁶ Holmes-Sellers, P., in *Pituitary Tumours*, ed. J. S. Jenkins, p. 64. London, Butterworths, 1973.
- ⁷ Ehlers, N., and Malmros, R., *Acta Ophthalmologica*, 1973, Suppl. 121.

Hospital Topics

Thyroid Function after Subtotal Thyroidectomy for Hyperthyroidism

DAVID EVERED, E. T. YOUNG, W. M. G. TUNBRIDGE, B. J. ORMSTON, E. GREEN, V. B. PETERSEN, P. H. DICKINSON

British Medical Journal, 1975, 1, 25-27

Summary

Among 76 patients who had had a subtotal thyroidectomy for hyperthyroidism from one to seven years previously recurrent hyperthyroidism was found in three and hypothyroidism in 13. The remaining 60 subjects were clinically euthyroid but a raised level of serum thyroid-stimulating hormone (TSH; $> 5.0 \mu\text{U/ml}$) was found in 39. Analysis of the data showed that their serum thyroxine was significantly lower than in the subjects with a normal TSH. The serum triiodothyronine (T-3) was similar in both groups. It is concluded that subjects with a raised TSH remain clinically euthyroid by maintaining a normal serum T-3 concentration. There was no evidence of any long-term progressive deterioration of thyroid function after subtotal thyroidectomy.

Introduction

Subtotal thyroidectomy is commonly practised in the management of hyperthyroidism. The incidence of hypothyroidism may lie between 3% and 35% and that of recurrent hyperthyroidism between 1.2% and 28%.¹ Hedley *et al.*^{2,4} have found a recurrence rate in the north-east of Scotland of 6% for hyperthyroidism and a point prevalence for hypothyroidism of 35%, but they also found a raised serum thyroid-stimulating hormone (TSH; $> 5 \mu\text{U/ml}$) in 40% of their subjects who were unequivocally euthyroid clinically and on the basis of routine biochemical investigations. The present study was undertaken to establish the level of thyroid function after subtotal thyroidectomy in a group of subjects from north-east England and to assess the significance of a raised serum TSH by measuring serum thyroxine (T-4) and triiodothyronine (T-3) concentrations.

Patients and Methods

All patients under the care of one surgeon (P.H.D.) who had undergone subtotal thyroidectomy for thyrotoxicosis during 1966, 1969, and 1972 were selected for study. All the operations were carried out by the surgeon, whose technique did not vary during this period. Eighty-nine subjects were selected for study, of whom eight had left the area and could not be traced and five had died from unrelated causes. Nine of the remaining 76 patients had been started on thyroxine after

Department of Medicine, University of Newcastle upon Tyne and Royal Victoria Infirmary, Newcastle upon Tyne NE1 4LP

DAVID EVERED, M.D., M.R.C.P., Consultant Physician
E. T. YOUNG, M.B., M.R.C.P., Consultant Physician
W. M. G. TUNBRIDGE, M.B., M.R.C.P., Senior Research Associate
B. J. ORMSTON, M.B., M.R.C.P., Research Registrar
E. GREEN, Laboratory Technician
V. B. PETERSEN, M.Sc., Biochemist
P. H. DICKINSON, M.S., F.R.C.S., Consultant Surgeon

biochemical confirmation of hypothyroidism and they were not studied further.

The 67 patients who were selected for clinical and biochemical study were seen by one of three observers (D.E., M.T., E.Y.), who made a detailed clinical assessment. Systematic inquiry between observers was achieved by using established questionnaires for hypothyroidism⁵ and hyperthyroidism⁶ though the published scores were not used in the final assessment.

Serum TSH was estimated on all subjects using a double antibody radioimmunoassay,⁷ results being expressed as μU of M.R.C. standard 68/38. The upper limit of normal established on a non-hospital population is $5 \mu\text{U}/\text{ml}$. Serum T-4 was measured by a competitive protein-binding technique (Thyopac-4, Radiochemical Centre, Amersham, normal range $4.7\text{--}11.9 \mu\text{g}/100 \text{ ml}$). The serum T-3 concentration was measured on unextracted human serum by a modification of the radioimmunoassay technique of Hesch and Evered.⁸

Results

Recurrent Hyperthyroidism.—Three patients (4%) were thought to be hyperthyroid clinically despite a normal score in two and an equivocal score in the other on the thyrotoxicosis index.⁶ These three subjects were later found to have the highest values for T-4 ($17.2 \mu\text{g}$, $16.5 \mu\text{g}$, and $11.1 \mu\text{g}/100 \text{ ml}$) and T-3 (3.50 ng , 2.42 ng , and $2.95 \text{ ng}/\text{ml}$) in the survey. Serum TSH was $1.2 \mu\text{U}/\text{ml}$ in one patient and undetectable in the other two. Two of these patients had been operated upon in 1969 and one in 1972.

Hypothyroidism.—A clinical diagnosis of hypothyroidism was made in four patients, of whom only one was hypothyroid on the index of Billewicz *et al.*⁵ Two had equivocal scores. These four subjects had the highest TSH values in the survey ($36 \mu\text{U}$, $48 \mu\text{U}$, $47 \mu\text{U}$, and $29 \mu\text{U}/\text{ml}$), all four had low T-4 values ($2.6\text{--}3.7 \mu\text{g}/100 \text{ ml}$), and three had very low T-3 values ($<0.10\text{--}0.19 \text{ ng}/\text{ml}$). The T-3 value was $1.38 \mu\text{g}/\text{ml}$ in the remaining patient, and this value was confirmed on repeating the assay. This patient was known to have been taking a thyroid hormone preparation until three weeks before the survey. Nine subjects had been started on T-4 for hypothyroidism after biochemical confirmation of the diagnosis, making a total of 13 patients with clinical hypothyroidism—a prevalence of 17% in this post-thyroidectomy group. Seven of these patients had been operated on in 1966 and six in 1972.

Euthyroid Patients.—Sixty patients (79%) were assessed as being clinically euthyroid despite equivocal scores on the Billewicz index⁵ in eight. TSH values ranged from <0.5 to $29.0 \mu\text{U}/\text{ml}$. The serum TSH was raised ($>5.0 \mu\text{U}/\text{ml}$) in 39 (65%) of this group. Casual inspection of the results suggested that the proportion of euthyroid subjects with a raised TSH diminished with time from the operation as 14 of the patients had undergone operation in 1966, seven in 1969, and 18 in 1972 but this impression was not borne out on formal analysis. Of the 21 patients with normal TSH 12 were operated on in 1966, four in 1969, and five in 1972. There were no significant differences in the clinical scores or TSH, T-4, or T-3 values in the euthyroid patients between subjects studied at one, four, and seven years after operation. These data were further analysed with this group subdivided into those with a normal TSH and those with TSH $>5.0 \mu\text{U}/\text{ml}$. The clinical scores on both indices used were similar (fig. 1). The mean serum T-4 in ($\pm \text{S.D.}$) the group with a normal TSH was $8.0 \text{ S.D. } \pm 1.1 \mu\text{g}/100 \text{ ml}$, and in those subjects with a raised TSH it was $7.01 \text{ S.D. } \pm 1.8 \mu\text{g}/100 \text{ ml}$. This difference in T-4 concentration was significant ($0.025 > P > 0.01$). There was no difference in T-3 concentration between subjects with a normal TSH ($1.35 \pm 0.36 \text{ ng}/\text{ml}$) and those with a raised TSH ($1.36 \pm 0.32 \text{ ng}/\text{ml}$)

though a greater measured range was noted in the latter group (fig. 2). Five subjects in the normal TSH group and seven of those with a raised TSH had circulating thyroid antibodies.

FIG. 1—Clinical scores in 60 euthyroid subjects on hyperthyroidism⁶ and hypothyroidism⁵ indices.

FIG. 2—Thyroid hormone concentrations in 60 euthyroid subjects.

Discussion

The clinical and laboratory assessment of thyroid function after subtotal thyroidectomy often poses problems. We studied this group of patients at different periods after subtotal thyroidectomy. Recurrent hyperthyroidism was recognized in 4% of subjects—a figure similar to that recently reported from the north-east of Scotland.³ The laboratory confirmation of the diagnosis presented no problems since

these subjects had the highest T-4 and T-3 values recorded in the survey. The use of an established index⁶ was unhelpful in identifying these patients.

The clinical features of hypothyroidism had been previously recognized in 12% of patients and the diagnosis confirmed, and a further four subjects were found to be clinically hypothyroid when recalled for study. This group had the four highest TSH values and lowest T-4 values in the survey. The T-3 values were also very low in three of these patients, the fourth value lying within the normal range. The use of a clinical index again proved to be of little value.⁹

Altogether 79% of patients were clinically euthyroid at the time of survey and they were found to be clinically and biochemically similar irrespective of time since operation. Of this group 65% had a raised serum TSH. Our study of patients a year or more after subtotal thyroidectomy suggests that the serum TSH may remain consistently raised for many years. It is difficult, however, to be certain that there is no change in thyroid function over the years since patients who develop clinical thyroid failure, and who have the highest TSH values,¹⁰ are progressively removed from this follow-up group for treatment.

The significance of a raised serum TSH in asymptomatic subjects has been the subject of much controversy.¹⁰⁻¹³ It has now been established in a large-scale community survey that TSH values over 5 μ U/ml are seen in less than 2.5% of the normal population. Now that the normal range of serum TSH concentrations in normal subjects has been defined it may be assumed that any increase in serum TSH concentration reflects downward deviation from the optimum level of circulating thyroid hormones and to some extent gives an indication of the magnitude of that deviation. This contention is supported by our data. The mean serum T-4 in the euthyroid subjects with a normal TSH was very similar to that observed in a normal population. The serum T-4 in the group with a raised serum TSH was significantly lower but still within the normal range. The serum T-3 concentrations were similar in both groups. These findings confirm similar observations in radiiodine-treated patients.^{14 15} Hence probably this minor reduction in total thyroid hormone concentration is sufficient

to induce a rise in serum TSH but insufficient to produce the clinical features of thyroid failure. The maintenance of the serum T-3 level in patients with mild and subclinical thyroid failure has been reported previously^{10 16} and was confirmed in our study. This presumably reflects a compensatory mechanism, probably TSH dependent, whereby smaller amounts of iodine are used to produce a metabolically more potent thyroid hormone. The finding of a normal or mildly raised T-3 in the face of a raised serum TSH shows that T-3 cannot be the sole regulator of pituitary TSH release.

Subtotal thyroidectomy in this series rendered 79% of patients clinically euthyroid. The high prevalence of raised serum TSH levels in euthyroid subjects after thyroid surgery is confirmed and can be accounted for by minor changes in circulating thyroid hormone concentration. The possible long-term significance of a minor reduction in serum T-4 and increase in serum TSH is not certain at present and will require further long-term studies.

Much of this work was carried out during the tenure of a Wellcome Senior Research Fellowship in Clinical Science by D.E. The support of the M.R.C. is gratefully acknowledged.

We thank Professor R. Hall and Dr. F. Clark for permission to study some of the patients reported here.

References

- Hedley, A. J., et al., *British Journal of Surgery*, 1972, 59, 559.
- Hedley, A. J., et al., *British Medical Journal*, 1970, 1, 519.
- Hedley, A. J., et al., *British Medical Journal*, 1971, 4, 258.
- Hedley, A. J., et al., *Lancet*, 1971, 1, 455.
- Billewicz, W. Z., et al., *Quarterly Journal of Medicine*, 1969, 38, 255.
- Gurney, C., et al., *Lancet*, 1970, 2, 1275.
- Hall, R., Amos, J., and Ormston, B. J., *British Medical Journal*, 1971, 1, 582.
- Hesch, R.-D., and Evered, D. C., *British Medical Journal*, 1973, 1, 645.
- Evered, D. C., et al., *British Medical Journal*, 1973, 3, 131.
- Evered, D. C., et al., *British Medical Journal*, 1973, 1, 657.
- Himsworth, R. L., and Fraser, P. M., *British Medical Journal*, 1973, 3, 295.
- Evered, D. C., and Hall, R., *British Medical Journal*, 1973, 3, 695.
- Ikram, H., Banim, S., and Fowler, P. B. S., *Lancet*, 1973, 2, 1405.
- Tunbridge, W. M. G., Harsoulis, P., and Goolden, A. W. G., *British Medical Journal*, 1974, 3, 89.
- McDougall, R., et al. In preparation.
- Wahner, H. W., and Gorman, C. A., *New England Journal of Medicine*, 1971, 284, 225.

Comparative Study between Endoscopy and Radiology in Acute Upper Gastrointestinal Haemorrhage

A. M. HOARE

British Medical Journal, 1975, 1, 27-30

Summary

A total of 158 patients with acute upper gastrointestinal haemorrhage were studied, and the 53 patients on whom emergency endoscopies were performed were compared with the remaining 105. The cause of the bleeding was found in 51 of the endoscopy group and 39 of the control group. Three patients in the endoscopy group and 16 controls died. In the endoscopy group the correct preoperative diagnosis

was made in all cases and there was less delay before operation. In the control group five patients had no diagnosis before operation, the preoperative diagnosis was wrong in nine, and five had laparotomies during which no cause of bleeding was found. The patients in the endoscopy group who did not have operations had a shorter stay in hospital than the controls.

Introduction

Emergency endoscopy of the oesophagus, stomach, and duodenum in patients with acute upper gastrointestinal haemorrhage provides a more precise method of diagnosis than emergency radiology.¹⁻³ It is not known if this benefits the patient, however, as no comparative series have been published. This paper reports a retrospective comparative study in which morbidity and mortality were assessed.

King's College Hospital, London S.E.5

A. M. HOARE, M.B., M.R.C.P., Registrar (Present address: Queen Elizabeth Hospital, Edgbaston, Birmingham B15 2TH)