A regional study of thyroidectomy: surgical pathology suggests scope to improve quality and reduce cost

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This study of thyroid histopathological data from hospitals in the South West Thames region was undertaken to assess current practice and the scope for improvement. Over a 6 month period, 186 thyroid operations were performed on 179 patients at eight hospitals serving almost 1.7 million people.

The frequency of thyroidectomy in different hospitals varied from 13 to 35 per 100 000 per year and 6.4% of the operations were second thyroidectomies. Benign multinodular goitre was the most common histological finding (34%). A benign solitary nodule was found in 36% and malignancy in 8.4% of the specimens. Correlation of histological analysis and type of operation suggested that a variety of operations were performed for the same pathological condition and that some operations were diagnostic procedures only. Overall, 63 of the 186 operations (34%) might have been avoided by a firm preoperative diagnosis. Only 67 thyroid fine needle aspiration biopsies (FNAC) were performed at the eight hospitals during the study period. Only 15 (8%) of the patients who underwent thyroid operation had been investigated by FNAC.

Reduction in thyroid surgery through more widespread use of FNAC could result in savings of £100 000 per million population per year. Regional activity data show that more than 50 surgeons currently undertake a workload of less than 500 thyroidectomies each year. Increased subspecialisation may be required to reduce costs and raise standards.

Enlargement of the thyroid gland, which normally weighs 25–30 g, is relatively common and affects about 15% of the population [1]. Solitary nodules are the cause of about half of these enlargements. The rest are usually secondary to multinodular goitre, but generally enlarged glands may also contain a dominant nodule requiring a tissue diagnosis. The most common indication for surgery in patients with a solitary nodule is suspicion of malignancy and yet malignancy is found in only 6–14% of solitary nodules [2-4]. The majority of thyroid malignancies are associated with a good prognosis, given appropriate surgical management. The outcome in thyroid malignancies with a poor prognosis may not be improved by surgery. The selection of patients for operation and the choice of an appropriate resection requires a reliable preoperative diagnosis or one established by frozen section at the time of surgery.

It is well known that fine needle aspiration cytology (FNAC) can improve preoperative diagnosis and a previous study in South West Surrey had suggested that half of the patients with solitary nodules could have been spared operations [5]. The present regional study was undertaken to test that hypothesis over a larger area and to study the scope for improvement in quality, cost savings and subspecialisation.

Table I. Size of populations served by participating hospitals and number of thyroidectomies performed

| Hospital | Thyroidectomies | | Rate/year per 100 000 | Lobectomies per partial lobectomy |
	Population	Patients		
1	167 300	29/29	35	2
2	186 900	29/28	31	1.7
3	236 500	29/28	25	5
4	182 700	22/22	24	4.6
5	275 900	27/26	20	3
6	208 000	20/19	19	13
7	244 300	18/16	15	7
8	182 500	12/11	13	3.5
	1 684 100	186/179	Mean 22	

Methods

A retrospective review of thyroid surgery was undertaken in the South West Thames Region over a 6 month period from July 1992 to January 1993. Data were contributed by eight district general hospitals covering a population of almost 1.7 million (Table I). The details of all thyroid specimens received for cytological and histological analysis were obtained from pathology returns and correlated. Pathological specimens were divided into six groups by gross and histological features: general enlargement due to multinodular and diffuse goitre, benign solitary nodule, malignant solitary nodule, thyrotoxicosis, thyroiditis and normal thyroid tissue. This last was usually removed at a second operation when malignancy had been diagnosed as a result of primary surgery. Any preoperative cytological diagnosis was compared with the final histological diagnosis. Operations were classified as total and subtotal thyroid-ectomy, total lobectomy, partial lobectomy or excision of residual thyroid tissue, and the treatment was compared with the final histological diagnosis.

A further study was undertaken in the Royal Surrey County Hospital to review the episode data of 60 consecu-tive patients undergoing all types of thyroid surgery. Cost estimates derived from the contracting process were used to estimate the total inpatient cost. Prices for thyroid-ectomy in two private and eight NHS hospitals in the area were as quoted to a local fund-holding practice. Population data and the incidence of thyroid cancer were obtained from the Thames Cancer Registry (Cancer in South East England, 1990) *(6)*.

Results

In all, 186 thyroid operations were performed on 179 patients at the eight hospitals involved in this study. The frequency of thyroidectomy varied from 13 to 35 per 100 000 per year (Table I). Seven patients underwent early reoperation during the study and five of 179 patients had already undergone thyroid surgery before the study period, giving a total of 12 (6.4%) second thyroidec-

tomies. The age range was 16 to 87 years with a mean of 50 years, and four-fifths (145, 81%) of the patients were female. During the study period, only 67 FNAC examinations were undertaken on all thyroid cases. In only 15 of 179 patients (8%) who underwent thyroid surgery was FNAC performed preoperatively. In all hospitals except one the most commonly performed operation was lobectomy. In one hospital most patients were treated by subtotal and total thyroidectomies. The number of total lobectomies per partial lobectomy varied from 1.7 to 13 (Table I).

The resected specimens were divided into groups based upon gross and histological criteria (Table II). Benign multinodular goitre was the most common single finding (64, 34%) with 67 (36%) of thyroid specimens showing a benign solitary nodule. Table II also indicates those operations where only a small amount of benign tissue was removed or where a second operation might have been avoided by a clear preoperative diagnosis. A total of 63 of 186 operations (34%) are in this group of probably inappropriate surgery.

The extent of the thyroid surgery performed for solitary thyroid nodule or non-toxic thyroiditis is shown in Table III. Similar pathological conditions, notably follicular adenoma, variants of follicular adenoma and papillary carcinoma were treated by a variety of operations. Of the 38 follicular adenomas, 24 were treated by total lobectomy but 10 by partial lobectomy and four by subtotal thyroidectomy. It is accepted that lobectomy is the best treatment for benign follicular adenoma, its variants and recurrent cysts, and that total thyroidectomy is the treatment of choice for medullary carcinoma. In 25 (36%) of these operations, therefore, the extent of the resection could be considered inappropriate.

In all, 67 FNACs were reported from the eight hospitals during the study period. Fifteen (22%) of the specimens were inadequate. Table IV shows the correlation between the cytological diagnosis of the 15 patients who subsequently underwent thyroid surgery and the final histological diagnosis. In no case did FNAC lead to unnecessary or inappropriate operation.

In Guildford over the last 2 years (1992–1993) the rate of thyroidectomy was 124 per million per year compared with

Table II. Histology of 186 resected specimens

Histology	n	%	Potentially avoidable resections
Benign			
Multinodular goitre	64	34.4%	19 specimens < 40 g
Follicular adenoma	38	20.4%	0
Variants of follicular adenoma*	19	10.2%	18 specimens < 40 g
Thyrotoxicosis	20	10.8%	0
Cyst	10	5.4%	10
Hashimoto's thyroiditis	6	3.2%	5 specimens < 30 g
Other thyroiditis	5	2.7%	3 specimens < 40 g
Normal	9	4.8%	5 †
Malignant			
Papillary carcinoma	8	4.3%	0
Follicular carcinoma	2	1.1%	0
Medullary carcinoma	2	1.1%	0
Anaplastic carcinoma	1	0.5%	1
Non-Hodgkin's lymphoma	1	0.5%	1
Sarcoma	1	0.5%	1
Total	186		63 (34%)

* Variants of follicular adenoma included fetal and Hürthle cell adenomas
† Included all five patients who had a completion thyroidectomy after unsuspected medullary carcinoma (*n* = 1) and papillary carcinoma (*n* = 4) found at first operation. One resection for adjacent malignancy and three resections for unspecified indications

Table III. Different operations performed for individual pathological lesions

Histological diagnosis	Sub-total (9)	Lobectomy (57)	Partial lobectomy (22)
Benign solitary nodule			
Follicular adenoma	4	24	10
Non-follicular adenoma		12	7
Cyst		7	3
Malignant solitary nodule			
Papillary carcinoma	2	6	
Follicular carcinoma		2	
Medullary carcinoma	1		
Non-toxic thyroiditis			
Chronic lymphocytic thyroiditis } Hashimoto's	1	4	1
} lymphocytic		1	1
Riedel's	1	1	
Granulomatous (de Quervain's)		1	

the regional mean of 221 per million per year. Average inpatient stay was 5 days (range 2–14 days) for all types of thyroidectomy (Table V). The cost of thyroidectomy in Guildford based on a 5 day inpatient stay has been estimated to be £1539 (Table VI), broadly agreeing with NHS contract prices for thyroidectomy at four other NHS hospitals, but wide variations were seen (Table VII). The costs of private care in a private and an NHS hospital were found to be less than some NHS prices.

Regional health authority activity data showed that less than 500 thyroid operations were carried out each year under the care of more than 50 surgeons.

Table IV. Correlation of cytological with histological diagnosis in 15 patients

	Histological diagnosis	
Cytological diagnosis	Benign	Malignant
Benign	10	—
Malignant	—	—
Suspected malignancy	—	1
Follicular neoplasia	2	—
Non-representative	2	—
Total	14	1

Table V. Episode duration for all thyroid operations, Royal Surrey County Hospital 1992–1993

Operation	Number	Episode duration (days)	Mean (days)
Total thyroidectomy	5	4–8	4.8
Subtotal thyroidectomy	17	4–13	6.8
Total lobectomy	30	3–14	4.7
Partial lobectomy	3	5–8	6
Other	5	2–8	4.2
Total	60	2–14	5.35

Table VI. Local estimated costs of thyroidectomy surgery (mean 5 day inpatient stay)

Outpatient costs	
Initial diagnosis and follow-up	£154.00
Inpatient costs	
Medical	£147.85
Theatre	£152.59
Ward	£929.54
Estates	£155.00
Total	£1539.98

Discussion

The results of this regional study support findings reported from the Royal Surrey County Hospital that the number of thyroid operations could be reduced *(5)*. We suggest that if the algorithm shown in Fig. 1 were followed, at least 63 (34%) of the 186 thyroid operations reported here might have been avoided. Thyroidectomy is absolutely indicated for the resection of some types of thyroid malignancy, namely tumours such as papillary,

Table VII. Thyroidectomy: NHS and private practice prices

London teaching hospital	£907
District general hospital	£1118
District general hospital	£1181
Private hospital	£1426
London teaching hospital	£1440
District general hospital	£1469
London teaching hospital	£1892
London teaching hospital	£2117
Private patient in DGH	£2559
Private hospital	£2748
London teaching hospital	£3390

follicular and medullary carcinomas. Relative indications include nodular goitre, particularly with central compartment compression, thyrotoxicosis and for the firm diagnosis of symptomatic or proliferative thyroid conditions.

There is little evidence to suggest that FNAC would alter the decision to operate in thyrotoxicosis or large goitre, but the test can reveal unsuspected pathology *(7)* and its use is neither harmful nor misleading *(8)*. However, it is in the management of the solitary thyroid nodule or a dominant nodule in a generally enlarged gland that FNAC is most valuable in suggesting the correct management. At present, a wide variety of thyroid operations is commonly performed to exclude or treat suspected malignancy *(9–11)*. That variation suggests significant differences in the quality of the service (Table III).

Most experienced thyroid surgeons would accept that there are compelling arguments against anything less than total lobectomy *(12)*. Partial lobectomy is an inadequate treatment for malignancy and residual tissue may lead to a second exploration which carries an increased risk of recurrent laryngeal nerve injury *(13)* and hypoparathy-
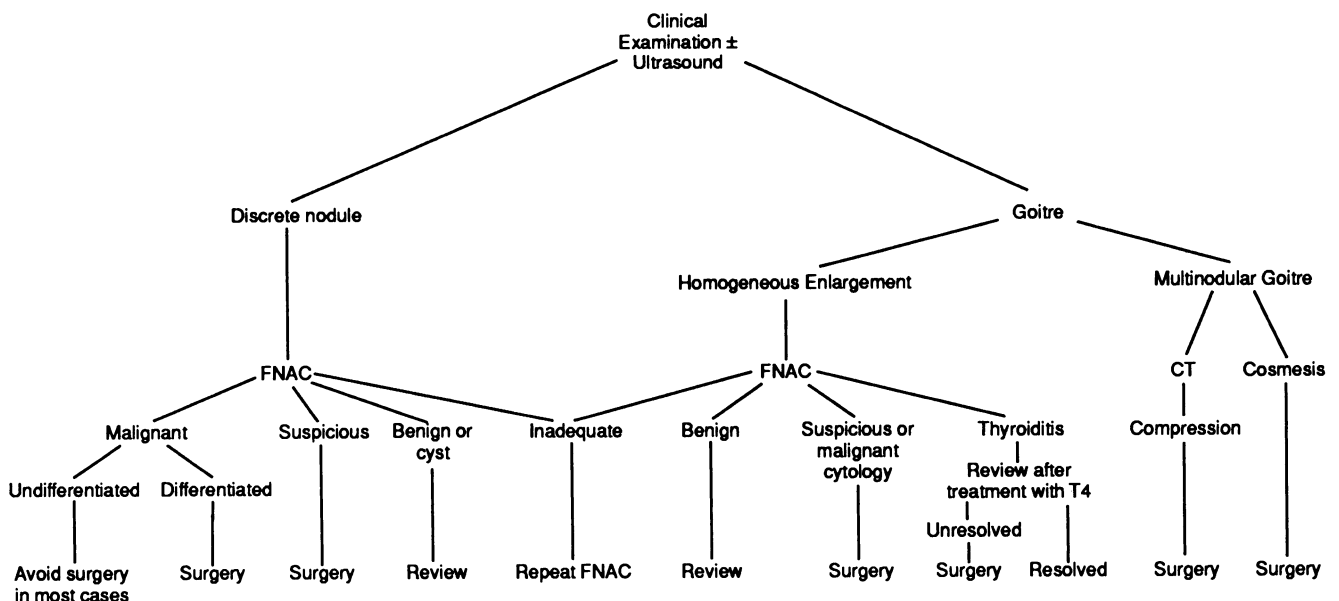

Figure 1. Suggested algorithm for the management of non-toxic thyroid swelling.

roidism. We have therefore used the ratio of total lobectomy to partial lobectomy as an indication of surgical quality and found it to vary widely from 1.7 to 13 in different hospitals.

In the diagnosis of thyroid malignancy, clinical examination, hormone assays, ultrasound examination and isotope scanning are of limited value (14), but FNAC can detect malignancy and also identify those patients with benign conditions who may not need surgery. When surgery is desirable a resection appropriate to the pathology may be planned. In large multinodular goitres, FNAC may reveal other pathological conditions and it is also valuable in the diagnosis of thyroiditis. Many lesions which appear clinically suspicious of malignancy can be firmly diagnosed and in such situations the number of operations may be reduced from 37% to 15% (15).

In the series reported here, FNAC and a firm preoperative diagnosis might have spared four patients with papillary carcinoma and one patient with medullary carcinoma an unnecessary second thyroid operation in which normal thyroid tissue was removed. Surgery might have been avoided in some patients with anaplastic carcinoma, sarcoma, lymphoma and non-toxic thyroiditis (Table II). Of the 64 multinodular goitres resected, 19 weighed less than 40 g and were therefore unlikely to cause compression or cosmetic embarrassment. Perhaps the indication for surgery in these 19 patients was to exclude malignancy, although the incidence of coexistent malignancy in surgically treated multinodular goitre is 7.5% (16) while it is 6–14% in true solitary swellings (3,4). FNAC is equally suitable for diagnosis of dominant nodules in a diffusely enlarged gland (17).

The limitations of cytology in the diagnosis of some thyroid malignancies are well recognised; in particular, it is not possible to differentiate between follicular carcinoma and follicular adenoma. This is defined by histopathology, identifying capsular or vascular invasion in follicular malignancy. There are also difficulties in the cytological detection of some papillary carcinomas because of associated thyroid pathology, including thyrotoxicosis, multinodular goitre, and marked cystic change.

All diagnostic techniques should be assessed for sensitivity and specificity (18). Experience has shown that in FNAC false-positives are very rare and false-negatives can be reduced to low levels if aspiration techniques are good (2,8). There were no false-negatives in our study. Serious errors of management are unlikely to occur as a result of a false-negative report if the patient is carefully followed up and the FNAC repeated. False-positives are obviously undesirable but often lead to a safe surgical approach. Without FNAC, such patients would be submitted to a diagnostic thyroidectomy. A false-positive diagnosis in thyroid disease does not necessarily have the serious consequences that it could in breast disease. However, 15 of 67 (22%) FNAC samples in our series were inadequate. This suggests scope for technical improvement in mastering this technique. It is a rapid and inexpensive test costing less than £35 in Guildford and complications are minor and uncommon.

Thyroid malignancy is an uncommon tumour of infinitely variable potential, but life-threatening thyroid malignancy is very rare. Although, in the USA it is estimated that new cases of thyroid cancer may number 50 per million per year (19), mortality is only 5 per million per year for men and 8 per million per year for women. Half these deaths will be due to aggressive forms of the disease, usually anaplastic cancer. These diagnoses can usually be firmly established by appropriate cytological techniques. In South West Thames, cancer is likely to be found in about 8% of thyroidectomies. Even allowing for a rate of 10%, only 2 per 100 000 would present each year, a figure which agrees with the data collected by the Thames Cancer Registry (6). Of these two cases, one would be best treated surgically (papillary, follicular or medullary carcinoma) and one probably non-surgically (anaplastic, sarcoma or secondary).

The mean frequency of thyroidectomy in the hospitals sampled was 221 per million population per year. The annual rate of thyroid cancer registration in south east England taken from the Thames Cancer Registry for 1990 was 17.4 per million. In our sample, the rate of malignant thyroid histology was 17.8 per million per year, indicating that our sample was representative. Surgery for thyroid malignancy in our sample represents less than 10% of all thyroid operations, of which three of 15 (20%) were for conditions in which operation would have been only diagnostic not therapeutic.

The survey shows a wide variation in the rate of thyroidectomy in different districts from 13 to 35 per 100 000 per year. Some variation might be caused by differences between the resident and catchment populations of each district, but the large range suggests real differences in clinical practice. In the light of the material removed, it also suggests scope for a further reduction in the number of operations. The cost savings of preoperative FNAC diagnosis have been estimated at 25% (20–22). Of all applications of FNAC in a district general hospital in the UK, thyroid FNAC had the highest potential cost savings per case (23). NHS pricing is not yet well defined (24) despite NHS guidance (25). The cost of thyroidectomy is not generally agreed and at present there is a wide variation in pricing for thyroidectomy between NHS hospitals. However, our data suggest possible savings of £100 000 per million population per year in South West Thames.

Fewer operations would inevitably reduce surgical experience and lead to greater subspecialisation. Activity data from South West Thames show that, of more than 50 surgeons undertaking thyroidectomy, each performs from one to 35 cases per year. In some hospitals, trainees manage a small number of patients with little supervision; in others they receive little supervised operative experience despite managing a large case load. Subspecialisation would seem desirable for better service and shorter training, but this is likely only if surgical services are provided by fewer larger hospitals. Guidelines suggest that one general surgeon is required for every 30 000 of the population and that efficient grouping requires a district general hospital to serve a population of

approximately 300 000 people *(26)*. Manpower projections indicate that the number of acute sites may need to be reduced to just over half of those available at present. The current study suggests that one surgeon could comfortably manage the thyroidectomy work generated by a population of 300 000.

This report indicates that there is considerable scope for reduction in the numbers of thyroidectomies performed and for an improvement in the precision of operations which are necessary. It provides further evidence for the use of FNAC before surgery on the grounds of quality and cost. A firm preoperative diagnosis would also permit the more refined prospective studies of thyroid surgery which are needed. These findings have significant implications for patients, purchasers of surgical services, surgical training and the strategic planning of acute services.

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