A cross-specialty survey to assess the application of risk stratified surgery for differentiated thyroid cancer in the UK

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ABSTRACT

INTRODUCTION This study describes variability of treatment for differentiated thyroid cancer among thyroid surgeons, in the context of changing patterns of thyroid surgery in the UK.

METHODS Hospital Episodes Statistics on thyroid operations between 1997 and 2012 were obtained for England. A survey comprising six scenarios of varying 'risk' was developed. Patient/tumour information was provided, with five risk stratified or non-risk stratified treatment options. The survey was distributed to UK surgical associations. Respondent demographics were categorised and responses analysed by assigned risk stratified preference.

RESULTS From 1997 to 2012, the Hospital Episode Statistics data indicated there was a 55% increase in the annual number of thyroidectomies with a fivefold increase in otolaryngology procedures and a tripling of cancer operations. Of the surgical association members surveyed, 264 respondents reported a thyroid surgery practice. Management varied across and within the six scenarios, and was not related consistently to the level of risk. Associations were demonstrated between overall risk stratified preference and higher volume practice (>25 thyroidectomies per year) ($p=0.011$), fewer years of consultant practice ($p=0.017$) and multidisciplinary team participation ($p=0.037$). Logistic regression revealed fewer years of consultant practice (odds ratio [OR]: 0.96/year in practice, 95% confidence interval [CI]: 0.922–0.997, $p=0.036$) and caseload of >25/year (OR 1.92, 95% CI: 1.044–3.522, $p=0.036$) as independent predictors of risk stratified preference.

CONCLUSIONS There is a substantial contribution to thyroid surgery in the UK by otolaryngology surgeons. Adjusting management according to established case-based risk stratification is not widely applied. Higher caseload was associated with a preference for management tailored to individual risk.

KEYWORDS

Thyroid – Cancer – Surgery – Risk-stratification

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Differentiated thyroid cancer (DTC), which includes papillary thyroid cancer (PTC) and follicular thyroid cancer (FTC), is rare but the incidence is rising dramatically.¹ The rarity and excellent long-term outcome pose challenges in defining optimal management. Staging systems including AMES (Age, Metastases, Extrathyroidal disease, Sex), MACIS (Metastases, Age, Completeness of excision, Invasion, Sex) and TNM (Tumour, Nodes, Metastases) reliably identify the majority of patients at low risk.^{2–4} However, management is not influenced consistently by these tools. The absence of conventional clinical randomised controlled trials means that the evidence base mainly comprises analysis of retrospective case series. Both current guidelines^{5,6} and large case series^{7–9} promote and describe a range of practice for the same extent of disease. For some tumours of identical low risk potential, the treatment delivered may vary from lobectomy alone to

total thyroidectomy, extensive nodal surgery and adjuvant radioiodine.

Patient morbidity can follow undertreatment or overtreatment of disease.¹⁰ Avoidable reoperations to the contralateral thyroid lobe or nodal fields and overzealous initial operations incur a higher risk of recurrent laryngeal nerve injury,¹¹ hypoparathyroidism¹² and unjustified morbidity,¹⁵ wasting resources. There are concerns that some guidelines recommend overtreatment for the majority of small tumours¹⁴ while *all* guidelines^{5,6,15,16} emphasise simultaneously that treatment related morbidity should be minimised.

Improved outcomes are associated with increased case volume in both thyroid surgery^{17–20} and the wider consideration of cancer management^{21–25} in a multidisciplinary team (MDT) setting.⁵ Traditionally the realm of general surgeons, often with an endocrine interest, thyroid surgery

has in the last 15 years seen a higher proportion of service delivery by ear, nose and throat (ENT)/head and neck surgeons.^{17,24}

Against this background of change, the utilisation of risk stratification is unknown. This study aimed to ascertain the degree of individualised, risk-based treatment for DTC undertaken by a UK-wide survey of thyroid surgeons and to correlate this with patterns of practice.

Methods

Hospital Episode Statistics (HES) data were obtained to examine trends in the number of thyroid operations carried out in England in 1997–1998 and 2011–2012.

An online tool (<http://www.surveymonkey.com/>) was chosen for survey development and dissemination. Information was requested regarding participants' clinical demographics including primary specialty affiliations (ENT, Endocrine, other), practice setting (District general vs university hospital), caseload (<10, <25, ≥25 thyroidectomies per year), years of consultant practice (split <10, 10–20, >20 for analysis) and MDT participation.

The instrument consisted of a series of six clinical scenarios, across a spectrum of disease risk and management options. The scenarios were developed following a systematic review of the literature.²⁵ A range of surgical interventions as applied to defined levels of disease was developed, including an acceptable, risk stratified range, which avoided both under and overtreatment (Fig 1). The range deemed 'appropriate' to disease risk was labelled risk stratified (RS) and that outside this range was labelled non-risk stratified (NRS) as defined by consensus with four international experts in thyroid cancer management. Adjuvant treatment was not addressed in the current study.

The scenarios described differentiated disease (PTC unless stated), with key features known to contribute to risk: size and extent of tumour, sex and age of patient,

multifocality and incidental nature of disease. Sufficient information was provided to assign AMES high or low risk and to derive a MACIS score (complete resection assumed) although these were not provided for the survey participants.

A spectrum of disease was covered with the majority of scenarios representing low risk disease, reflecting the proportion seen in practice and the lack of controversy over management of high risk cases. In each scenario, the five treatment options were ordered randomly but for clarity, they are presented in this paper in order of increasing risk. The scenarios are described in the results section below and in Appendix 1 (available online only). Respondents' overall RS preference was assigned cumulatively across the six scenarios. RS preference was deemed present if RS management was selected in the majority of scenarios (four or more).

Two scenarios (2 and 5) describe similar tumour presentations but at different ages, substantially altering risk. Preference around preoperative imaging was specifically investigated; ultrasonography is the most sensitive modality for staging lymph nodes but axial imaging (traditionally MRI)²⁶ may have a role for tumours with suspicion of local disease advancement²⁷ or in higher risk groups (eg scenario 5).

Survey dissemination

With the support of the executive of the Association of Surgeons of Great Britain and Ireland (ASGBI), the survey was endorsed by four relevant specialty associations with an email link sent to all consultant members. The associations were the British Association of Endocrine and Thyroid Surgeons (BAETS), ENT UK, the ASGBI and the Association of Breast Surgery (ABS). Multiple association membership was anticipated and captured in the survey to avoid duplicate responses. Respondents were asked to disseminate the email to non-member consultant colleagues with relevant practice. The survey closed two weeks following the initial email and one reminder was sent two days prior to closure.

Statistical analysis

The results were downloaded and analysed using SPSS® version 19 (IBM, New York, US). Descriptive statistics were used to describe the distribution of responses to the clinical scenarios and demographic data. McNemar's test was employed to compare the proportion of respondents opting for imaging in scenarios 2 and 5. Scenario specific univariate analyses (continuity correction tests for 2 × 2 comparisons, and chi-squared and independent t-tests as appropriate) were carried out (RS/NRS and scenario choice [scenarios 1–5] vs demographics). Combined scenario analysis was then performed (RS preference present/absent vs demographics); RS preference was deemed present if the respondent selected RS management options for four or more scenarios. Logistic regression was used to identify independent predictors of RS preference in the combined scenario analysis. In all analyses, statistical significance was taken at $p < 0.05$, with 95% confidence intervals (CIs) provided for estimates where appropriate.

If a scenario exhibited markedly different results from others, sensitivity analysis was carried out to examine the effects of: (a) varying the RS vs NRS cut-off in the management

Figure 1 Relationship between extent of surgery and risk of cancer

choices provided (altering summary results for that scenario and its distribution to the overall analysis); and (b) excluding the scenario from the overall analysis.

Results

HES data (personal communication from the National Clinical Analysis and Specialised Applications Team) showed that the number of thyroid operations in England increased from 7,726 in 1997–1998 to 12,019 in 2011–2012 (Fig 2). This was largely due to an increase in ENT/head and neck operations from 1,019 to 6,471. The number of cancer operations increased from 849 to 2,346. In 2011–2012, 635 surgeons carried out thyroid operations.

Surveyed population and respondents

Emails to the memberships of BAETS, ENT UK, ASGBI and ABS produced 629 responses from 483 surgeons: 201 had membership of more than one association. By specialty association, response rates were: 157/178 BAETS members (88%); 223/661 ENT UK members (34%); 310/1,127 ASGBI members (28%) and 102/435 ABS members (23%). Four responses from trainees were excluded from analysis.

Overall, 264 surgeons had a thyroid practice, with 139 of these having multiple memberships. This study population is described by a Venn diagram (Fig 3). A total of 251 of the 264 respondents (95.1%) provided answers to all six clinical scenarios.

Of the 264 respondents with a thyroid practice, 151 (57.2%) had an affiliation with BAETS and 138 (52.3%) with ENT UK. A total of 234 (88.6%) had an affiliation with ENT UK and/or BAETS. Full clinical demographic data were provided by 228 respondents (86.4%). Over half (130/228, 57.0%) worked in a district general hospital, with 120/228 (92.3%) participating in an MDT. Of the 98 respondents working in a university hospital, 92 (93.9%) participated in an MDT. Respondents' length of consultant practice ranged from 1 to 31 years (mean: 12.1 years, standard deviation: 7.8 years) and 17 (7.5%) performed fewer than 10 thyroid operations per year while 80 (35.1%) carried out fewer than 25 operations annually.

Management preferences and RS vs NRS practice

The six clinical scenarios, their AMES and MACIS criteria, the interventions and RS/NRS attributions are illustrated in Appendix 1 (available online only), with the number of respondents choosing each option. Overall, as disease risk increases, so does the magnitude of the preferred treatment option – but not without variation and inconsistency.

Scenario 1: The RS option was chosen by only 14.4% of respondents. Early reoperative surgery increases the risk of nerve injury and hypoparathyroidism with no survival benefit.

Scenario 2: The majority chose a RS option with total thyroidectomy and either no nodal or nodal surgery limited to the central compartment. A quarter (24.6%) opted for unnecessary lateral nodal surgery.

Scenario 3: A minority of 6.8% opted for further NRS nodal surgery.

Scenario 4: Only 1.9% opted for NRS imaging directed nodal surgery limited to the imaged lateral nodes when current evidence indicates that the central compartment nodes should be removed. In contrast, 20.5% opted unnecessarily for radical bilateral compartment nodal surgery.

Scenario 5: In this AMES high risk patient, there is no indication for prophylactic lateral compartment nodal surgery and the RS option is total thyroidectomy and central compartment node dissection. Similar proportions of respondents opted for undertreatment (18.6%) and overtreatment (15.2%).

Scenario 6: There was a striking preference (94.6%) for the NRS option of early reoperation in a low risk patient.

Scenarios 2 and 4 exhibited the most variation in results. Responses to scenario 6 (FTC) varied from the others, clustering towards more aggressive reintervention. Preference

for imaging in the high risk scenario 5 (69.1%) was significantly higher than in the low risk scenario 2 (61.8%) (McNemar's test $X^2=7.660$, $df=1$, $p=0.006$). Computed tomography was the preferred option in both scenarios.

Scenario specific analyses

The clinical scenarios were individually analysed for relationships between respondents' management strategy (RS or NRS) and respondents' clinical demographics. A summary of the results is given below.

Scenario 1: The lowest risk scenario showed little variation by respondent characteristics and choices were distributed uniformly among the respondents. Consultants in their middle years of practice showed the strongest RS preference. This was the only statistically significant finding ($X^2=6.719$, $df=2$, $p=0.035$).

Scenario 2: There were no statistically significant associations with respondent demographics.

Scenario 3: The responses to this scenario's older patient with incidental, low risk disease exhibited associations of interest. There was more RS preference among higher case-load surgeons (continuity correction 4.109, $df=1$ $p=0.045$) and MDT participants (continuity correction 4.047, $df=1$, $p=0.044$). Younger clinicians also showed a RS preference although this was not statistically significant ($X^2=5.554$, $df=2$, $p=0.169$). ENT specialists favoured more aggressive, individual treatment options than non-ENT groups ($X^2=11.186$, $df=4$, $p=0.025$), showing a non-significant RS preference when analysed by RS preference present/absent (continuity correction 1.866, $df=1$, $p=0.172$).

Scenario 4: This scenario describing an older patient with AMES low risk disease but nodal involvement again allowed respondents to exhibit a higher degree of RS preference associated with demographics. Higher case volume (continuity correction 5.756, $df=1$, $p=0.016$), MDT participation (continuity correction 5.120, $df=1$, $p=0.075$) and any ENT or endocrine specialty affiliation were predictors ($X^2=6.928$, $df=1$, $p=0.004$); of the RS options, option 4 was preferred among MDT participants ($X^2=10.678$, $df=4$, $p=0.030$). Older surgeons split their preferences towards the extremes of treatment whereas the responses of surgeons in their early and middle years of practice clustered in the centre. Non-specialists chose NRS treatment in 46.2% of cases, compared with 20.9% for ENT/endocrine surgeons.

Scenario 5: The responses to this high risk scenario exhibited strong predictive associations. Again, higher case volume (continuity correction 15.249, $df=1$, $p<0.001$) and MDT participation (continuity correction 9.464, $df=1$, $p=0.002$) were associated significantly with RS preference while ENT surgeons favoured more aggressive management options ($X^2=9.814$, $df=4$, $p=0.004$) albeit within the RS preference bracket. NRS options were favoured by surgeons with more years in practice (t-test -1.782, $df=226$, $p=0.047$).

Scenario 6: The responses to this scenario varied significantly from the others, with one NRS treatment option clearly favoured by all groups. The less invasive management options, chosen only by a minority, tended to be favoured by

consultants in their middle years of practice who were not MDT participants although this was not significantly related to RS preference. The combined endocrine and ENT specialists were significantly more likely to choose NRS treatment, preferring option 4 ($X^2=20.287$, $df=4$, $p<0.001$).

Combined scenario analyses

Overall RS preference was assigned (ie present or absent, each $n=122$, 46.2%). Respondents remained unassigned ($n=20$) if insufficient (ie ≤ 4) scenarios had been completed. Overall RS preference was independently significantly associated with higher volume practice (>25 cases per year), fewer years of consultant practice and MDT participation (Table 1). Combining all predictors in a multivariate logistic regression revealed fewer years of experience and a case-load of >25 per year as independent predictors of RS preference (odds ratio [OR]: 0.96 per cumulative year, 95% CI: 0.92–1.0, $p=0.036$; OR: 1.92, 95% CI: 1.04–3.52, $p=0.036$).

Sensitivity analyses

In view of scenario 6 exhibiting different patterns in results, sensitivity analysis was carried out. Option 4 (completion thyroidectomy) was reassigned as RS; on logistic regression analysis, the same conclusion was arrived at with the OR for operative volume increasing (OR: 1.20; 95% CI: 1.73–6.35, $p<0.001$). A second sensitivity analysis excluded this scenario from the cumulative analysis: 122 of 250 respondents with assignable status exhibited RS preference. On repeating analysis by clinical demographics, a higher case volume (>25 /year) ($p=0.025$) and specialty affiliation with ENT and/or endocrine surgery ($p=0.016$) were significantly predictive of RS preference. The association with years of practice was no longer found.

Discussion

This is the first cross-specialty survey of contemporary thyroid surgical practice in the UK. The survey indicates that clinical risk assessment is not generally used to determine the extent of treatment. This is consistent with the lack of consensus at guideline level and confirms considerable variation in practice. A preference for individualised, RS management plans is more likely among higher volume surgeons in the early/middle years of consultant practice. There was a trend for ENT surgeons to advise overtreatment of lymph nodes not related to the risk.

Previously, there have been numerical analyses of numbers of operations performed but without the detail requested in this study. HES data demonstrate a dramatic increase in the number of operations being carried out by ENT/head and neck surgeons, and although there was a similar increase in the number of cancers detected, the clinical significance of this is debatable.²⁸ The survey has captured the management preferences among surgeons with an interest in thyroid surgery from various disciplines and a wide range of practice (as gauged by specialty association memberships and hospital setting). Clearly, no information is gleaned on non-members of associations or

Table 1 Overall RS preference was independently significantly associated with caseload, MDT participation and years of consultant practice.

		RS preference present	RS preference absent	Test statistic	p-value
Caseload (n=228)	≥25/year	85 (57.4%)	63 (42.6%)	6.524, df=1	0.011
	<25/year	31 (38.8%)	49 (61.3%)		
MDT (n=244)	Participant	112 (52.8%)	100 (47.2%)	4.352, df=1	0.037
	Non-participant	10 (31.3%)	22 (68.7%)		
Hospital setting (n=228)	University	54 (55.1%)	44 (44.9%)	0.949, df=1	0.330
	District general	62 (47.7%)	68 (52.3%)		
Years in practice (n=228)	<10 years	46 (53.5%)	40 (46.5%)	8.170, df=2	0.017
	10–20 years	62 (55.4%)	50 (44.6%)		
	>20 years	8 (26.7%)	22 (73.3%)		
	Mean	11.01 years	13.15 years		
ENT affiliation (n=244)	Present	68 (51.1%)	54 (48.6%)	0.066, df=1	0.797
	Absent	65 (48.9%)	57 (51.4%)		
Endocrine affiliation (n=244)	Present	76 (53.9%)	65 (46.1%)	1.680, df=1	0.195
	Absent	46 (44.7%)	57 (55.3%)		
ENT/endocrine affiliation (n=244)	Present	115 (52.3%)	105 (47.7%)	3.743, df=1	0.530
	Absent	7 (29.2%)	17 (70.8%)		

RS = risk stratified; DF = degrees of freedom; MDT = multidisciplinary team; ENT = ear, nose and throat.

non-responding surgeons, in whom greater degrees of practice variation may exist. There is (inevitably in this type of survey) reliance on respondent integrity. However, internal validity of the survey is assured as there was expert input at every stage of the questionnaire development.

The survey format limited the extent of information given but only 20 respondents (7.6%) commented in free text boxes about the potential of fine needle aspiration/intraoperative tissue diagnosis in DTC to influence management. This could have influenced the extent of lymph node surgery in scenarios 2 and 4, which exhibited most variation in results. Both scenarios describe AMES low risk patients with possible node disease. If all described lymph nodes are positively involved in scenario 4, option 4 (total thyroidectomy, bilateral VI, right selective neck dissection II–V) would be deemed the safe option by most, with only around a quarter of respondents choosing to perform less intervention. In contrast, the younger patient with less implied disease in scenario 2 has no firm indication for a lateral neck dissection but around a quarter of respondents elected to carry this out.

It is generally accepted that patients who are clearly ‘high’ or ‘low’ risk will behave predictably. The survey did not attempt to address patients who fall into high risk groups because there is little controversy and minimal variation in treatment. An ‘intermediate’ risk group of middle aged patients with extensive nodal disease^{29–31} shows most uncertainty and least consensus in treatment guidelines,

and it is not unexpected that the greatest variation was observed in scenarios 2 and 4.

The final scenario, pertaining to FTC, is of particular interest. FTC is generally perceived to carry a worse prognosis than PTC; however, correcting for age and tumour size, the outcomes are equivalent to those of PTC.^{52,53} Prognostic indicators are not reported as widely as for PTC. In particular, the MACIS system was based entirely on PTC, in contrast to AMES, which was based on any follicular cell derived, differentiated disease. Despite this, independent data from Lo *et al*⁵⁴ and review of the evidence^{55,56} support the applicability of any of these systems to FTC.

Scenario 6 was constructed to test the limits of risk stratification – based on the probably unnecessary bias that FTC requires more aggressive management. This intermediate sized tumour, in a female patient on the TNM limit for higher risk disease, is representative of a ‘minimal’ encapsulated carcinoma, which is not a widely invasive tumour. Following AMES criteria, it can be treated as low risk disease and is only stage II. The multidisciplinary UK position document states: ‘No clear recommendations currently exist for low risk minimally invasive tumours of 2–4cm and these cases should be discussed individually at MDT. In some cases lobectomy and [thyroid stimulating hormone] suppression alone may be sufficient.’¹⁶ Only a minority of respondents (5.3%) would not choose further surgical intervention for this patient.

Extending strengths and weaknesses to compare with other studies

In terms of study population, a previous report on thyroid surgery in 1998–1999 stated that 15.4% of thyroid surgery was carried out by ENT surgeons, with 35% of ENT surgeons seeing thyroid outpatients.⁵⁷ As forecast in the same paper, the proportional distribution of specialty affiliation in our survey (52% ENT, 58% endocrine) indicates that the proportion of ENT surgeons with a thyroid practice has increased significantly. It has been hypothesised that ENT surgeons, with normal practice involving extensive head and neck dissections for squamous carcinoma, may perform more extensive surgery for DTC but this has not been assessed previously. Although ENT surgeons did cluster towards more extensive treatments, their practice remained more within RS than NRS preference.

Issues regarding case volume and setting (university vs district general hospitals, MDT participation) are well documented across the generality of surgery,^{22,38} cancer management^{21,23} and endocrine practice.^{19,20} These apply at both individual surgeon and hospital level with patients being more likely to receive appropriate surgical management for DTC in a higher volume centre.⁵⁹ BAETS recommends a minimum annual caseload of 25 thyroidectomies per year (personal communication from John Watkinson, Past President of BAETS, 2011) and the multidisciplinary guideline recommends 30.¹⁶ For endocrine surgical operations, surgeon volume correlates inversely with complication rates, length of stay and economic costs.¹⁹ Across all hospitals in two American states, high volume thyroid surgeons were more likely to operate on thyroid cancer and the smallest volume surgeons had disproportionately high complication rates. The same study, derived from billing data, could not differentiate between ENT/head and neck and general/endocrine surgeons.

Surgeons tend to overestimate case volume.⁴⁰ The current survey asked for caseload by three categories (<10, 10–25, >25 cases per year) to encourage those with 25 cases or fewer to respond but for later coding purposes, these formed two groups (1–25, >25 cases per year). It is of great relevance that a practice of >25 thyroidectomies per year was found to be associated significantly with RS preference across a range of scenarios, accounting for specialty. Our findings correlate with those of Duclos *et al*,⁴¹ indicating that thyroid surgeons aged between 35 and 50 years provide the safest care.

Implications for service and practice

In NICE's commentary on thyroid cancer management,⁴² in the context of head and neck cancers, data from the Northern and Yorkshire Cancer Registry audit for 1998–1999 showed that patients with thyroid cancer were most likely to be treated by general surgeons working outside an MDT. Substantial improvements appear to have been made in the last 15 years. Then, 59% of patients were treated by surgeons who dealt with fewer than ten cases in the two-year study period and in over a third of cases, treatment was given by surgeons whose caseload averaged two or fewer cancer cases per year. Half of consultants

operating on thyroid cancers participated in MDTs. However, only 56% of MDTs discussed every case routinely.

Although the current study does not capture the 'remote' practices, the proportion of respondents participating in an MDT from DGH or university settings is now much improved. Case volume, quality improvement and continuing professional development become pertinent, providing further evidence towards a more concentrated thyroid cancer service in the UK. The increase in thyroid operations over the study period leads to the question of what the indications for these are. While the increase in thyroid cancer diagnoses mirrors a worldwide trend and might appear to justify the increased activity, this probably reflects overdiagnosis and treatment of an occult subclinical pool of disease.

These findings support those of Vincent *et al*⁴⁵ in terms of working towards quality and safety assurance in surgical outcomes. A systems approach was recommended by this group, whereby multilevel measures of process (human, operative, environmental) as well as parallel outcomes are necessary. Only a prospective, adjusted data series capturing human factor aspects of decision making, teamwork, surgical process, and outcomes at organisational and patient level would allow a definitive analysis of the interaction of perceived tumour risk, and decisions around operative interventions and related outcomes. For a disease whose natural history precludes the conventional acquisition of level I/II evidence, cumulative evidence as set out here and in similar studies^{54,56} is currently the best available.

Conclusions

The present study has been independently useful in confirming variation in opinion given the lack of consensus across each of the scenarios. By comparing practice preferences with clinician demographics, we have identified strong associations in keeping with the published literature (if not causal relationships towards RS practice). Organisation of service delivery around a safe, rationalised practice then becomes a national level challenge.

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Appendix 1 Survey scenarios and responses

SCENARIO 1

A 34-year-old woman undergoes a left thyroid lobectomy for a recurrent 4cm cyst. Fine needle aspiration is Thy1c. Cystic aspirate is unsatisfactory. Histology confirms a benign cyst but an incidental 1.5cm papillary carcinoma is identified separately in the resected specimen; it has been completely excised. What is your management plan?

AMES low risk, MACIS 3.55, 99% 20-year survival

Response	RS vs NRS	n
Clinical review and TSH suppression	RS	38 (14.4%)
Radioiodine remnant ablation	NRS	0
Completion total thyroidectomy within 6 weeks	NRS	90 (34.1%)
Ultrasonography, then completion total thyroidectomy, with directed nodal surgery	NRS	88 (33.3%)
Completion total thyroidectomy with left central compartment dissection within 6 weeks	NRS	48 (18.2%)
Total		264 (100%)

SCENARIO 2

A 26-year-old man presents to clinic with a clinically suspicious, 5cm swelling in his right thyroid lobe. Fine needle aspiration is Thy5, consistent with papillary carcinoma. He has no palpable lymphadenopathy and undergoes preoperative ultrasonography of the neck, showing only minimal lymph nodes (<1cm) at level II (right). What is your next step?

Do you order further imaging? Yes / No If yes: CT or MRI?

Of 260 respondents, 161 (61.9%) indicated they would obtain further imaging, with 100 (62.1%) choosing CT.

The imaging has shown only three nodes (<1cm) at level II (right), likely reactive. What is your next step?

AMES low risk, MACIS 4.60, 99% 20-year survival

Response	RS vs NRS	n
Right thyroid lobectomy alone	NRS	3 (1.1%)
Total thyroidectomy alone	RS	37 (14.0%)
Total thyroidectomy with right central compartment dissection	RS	59 (22.3%)
Total thyroidectomy with bilateral central compartment dissection	RS	96 (36.4%)
Total thyroidectomy with right selective neck dissection	NRS	65 (24.6%)
Total		260 (98.5%)

SCENARIO 3

A 56-year-old woman undergoes a total thyroidectomy for Graves' disease. Histology reveals two foci of papillary carcinoma, both completely excised and well differentiated, measuring 0.9cm in the right lobe and 1.8cm in the left. There are no adverse histological features. Her thyroglobulin level is undetectable. What is your next surgical step?

AMES low risk, MACIS 5.02, 99% 20-year survival

Response	RS vs NRS	n
Clinical review and TSH suppression	RS	88 (33.3%)
Ultrasonography – which is negative – so proceed with clinical review and TSH suppression	RS	154 (58.3%)
Ultrasonography – which is negative – so perform bilateral central compartment dissection	NRS	7 (2.7%)
Left-sided central compartment dissection, examining the right side to exclude macroscopic nodes	NRS	2 (0.8%)
Bilateral central compartment dissection	NRS	6 (2.3%)
Total		257 (97.3%)

SCENARIO 4

A 62-year-old man presents with a 3.5cm swelling in his right thyroid lobe. Preoperative staging reveals suspicious nodes at levels III and IV on the right, and at level VI on the left. Assuming no other suspicious nodes are found at surgery, what operation do you perform?

AMES low risk, MACIS 6.01, 89% 20-year survival

Response	RS vs NRS	n
Total thyroidectomy, left VI, right selective neck dissection III and IV	NRS	5 (1.9%)
Total thyroidectomy, bilateral VI, right selective neck dissection III and IV	RS	51 (19.3%)
Total thyroidectomy, left VI, right selective dissection II–V	RS	18 (6.8%)
Total thyroidectomy, bilateral VI, right selective neck dissection II–V	RS	123 (46.6%)
Total thyroidectomy, bilateral VI, bilateral selective neck dissection II–V	NRS	54 (20.5%)
Total		251 (95.1%)

SCENARIO 5

A 78-year-old woman presents with a hard, suspicious thyroid mass, measuring around 5cm in her left thyroid lobe. There are no symptoms of local infiltration; there are no clinically suspicious nodes. Fine needle aspiration is consistent with papillary carcinoma. She undergoes ultrasonography of the neck, showing only minimal lymph nodes (<1cm) at level II (left). What is your next step?

Do you order further imaging? Yes / No If yes: CT or MRI?

Of 249 respondents, 175 (70.3%) indicated they would obtain further imaging, with 108 (61.7%) choosing CT.

The imaging has shown only three nodes (<1cm) at level II (left), likely reactive. What is your next step?

AMES high risk, MACIS 7.74, 56% 20-year survival

Response	RS vs NRS	n
Right thyroid lobectomy	NRS	5 (1.9%)
Total thyroidectomy	NRS	44 (16.7%)
Total thyroidectomy, left central compartment dissection	RS	53 (20.1%)
Total thyroidectomy, bilateral central compartment dissection	RS	107 (40.5%)
Total thyroidectomy with left selective neck dissection and central compartment dissection	NRS	40 (15.2%)
Total		249 (94.3%)

SCENARIO 6

A 45-year-old woman undergoes a diagnostic thyroid lobectomy for a 2.5cm isolated thyroid swelling in her right lobe. Fine needle aspiration on two occasions shows Thy2 and Thy3. Histology demonstrates a minimally invasive follicular carcinoma with three areas of capsular invasion and one area of vascular invasion. What is your management plan?

AMES low risk

Response	RS vs NRS	n
Active observation/clinical review – no intervention	RS	2 (0.8%)
TSH suppression and clinical review	RS	10 (3.8%)
Radioiodine ablation of contralateral lobe	RS	2 (0.8%)
Completion thyroidectomy within 6 weeks	NRS	161 (61.0%)
Completion thyroidectomy and right VI dissection within 6 weeks	NRS	69 (26.1%)
Total		244 (92.4%)

RS = risk stratified; NRS = non-risk stratified; AMES = Age, Metastases, Extrathyroidal disease, Sex; MACIS = Metastases, Age, Completeness of excision, Invasion, Sex; TSH = thyroid stimulating hormone; CT = computed tomography; MRI = magnetic resonance imaging