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Original Article

Post-thyroidectomy bleeding: analysis of risk factors from a national registry

H. E. Doran[1,*], S. M. Wiseman [2], F. F. Palazzo[3], D. Chadwick[4] and S. Aspinall[5]

[1]Department of Surgery, Salford Royal Hospital, Salford, UK
[2]Department of Surgery, St Paul's Hospital and University of British Columbia, Vancouver, British Columbia, Canada
[3]Department of Surgery, Hammersmith Hospital, Imperial College Healthcare NHS Trust, London, UK
[4]Department of Surgery, Nottingham University Hospitals NHS Trust, Nottingham, UK
[5]Department of Surgery, Aberdeen Royal Infirmary, Aberdeen, UK

*Correspondence to: Department of Surgery, Salford Royal Hospital, Stott Lane, Salford M6 8HD, UK (e-mail: hdoran@gmail.com)

Abstract

Background: Post-thyroidectomy haemorrhage occurs in 1–2 per cent of patients, one-quarter requiring bedside clot evacuation. Owing to the risk of life-threatening haemorrhage, previous British Association of Endocrine and Thyroid Surgeons (BAETS) guidance has been that day-case thyroidectomy could not be endorsed. This study aimed to review the best currently available UK data to evaluate a recent change in this recommendation.

Methods: The UK Registry of Endocrine and Thyroid Surgery was analysed to determine the incidence of and risk factors for post-thyroidectomy haemorrhage from 2004 to 2018.

Results: Reoperation for bleeding occurred in 1.2 per cent (449 of 39 014) of all thyroidectomies. In multivariable analysis male sex, increasing age, redo surgery, retrosternal goitre and total thyroidectomy were significantly correlated with an increased risk of reoperation for bleeding, and surgeon monthly thyroidectomy rate correlated with a decreased risk. Estimation of variation in bleeding risk from these predictors gave low pseudo-R^2 values, suggesting that bleeding is unpredictable. Reoperation for bleeding occurred in 0.9 per cent (217 of 24 700) of hemithyroidectomies, with male sex, increasing age, decreasing surgeon volume and redo surgery being risk factors. The mortality rate following thyroidectomy was 0.1 per cent (23 of 38 740). In a multivariable model including reoperation for bleeding node dissection and age were significant risk factors for mortality.

Conclusion: The highest risk for bleeding occurred following total thyroidectomy in men, but overall bleeding was unpredictable. In hemithyroidectomy increasing surgeon thyroidectomy volume reduces bleeding risk. This analysis supports the revised BAETS recommendation to restrict day-case thyroid surgery to hemithyroidectomy performed by high-volume surgeons, with caution in the elderly, men, patients with retrosternal goitres, and those undergoing redo surgery.

Introduction

Haemorrhage with associated laryngeal oedema and airway compromise occurs after 0.9–2.1 per cent of thyroid operations[1,2], and it is estimated that one-quarter of these patients will require immediate life-saving clot evacuation and 0.3 per cent may require a tracheostomy[3]. Postoperative haemorrhage is most likely to occur in the first 6 hours, with clinically significant haemorrhage after 24 hours being rare[4]. It has thus been common practice in the UK to undertake thyroid surgery as an inpatient, with an overnight stay[3,5,6].

Available evidence in 2011 did not permit the reliable identification of patients most at risk of bleeding, hence the British Association of Endocrine and Thyroid Surgeons (BAETS) consensus statement did not endorse day case thyroidectomy (discharge on the same day as surgery) on the grounds of the unquantifiable risk of post-thyroidectomy fatal airway obstructing haemorrhage[7]. Increasing demands on the finite resources available in the National Health Service (NHS) have led to a need for cost savings, and outpatient surgical procedures are seen as a cost-improvement opportunity. Inevitably the position of BAETS on day-case thyroidectomy has clashed with local hospital management initiatives, particularly in centres where day-case parathyroidectomy is performed[8]. Furthermore, although the UK stance on same-day discharge thyroidectomy is common throughout Europe, it differs from practice in the USA[9].

The growing literature on thyroid surgery safety has led to a momentum in the UK towards the acceptance of day-case neck endocrine operations in selected patients requiring targeted parathyroidectomy or low-risk thyroidectomy when the local healthcare provision is set up to deal with any complications[8]. Following review of UK Registry of Endocrine and Thyroid Surgery (UKRETS) data and further debate, BAETS amended its position to state that, as long as four conceptual criteria were satisfied, individual clinicians should not be hindered from the development of a clearly defined day-case hemithyroidectomy service. These criteria specify that the risk of postoperative haemorrhage be deemed low, informed consent should include the small additional risk of an off-site postoperative bleed and its consequences, verbal and written instructions on the

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departmental postoperative bleed protocol be provided, and the patient should have easily accessible competent healthcare facilities. These criteria are similar to those in the American Thyroid Association (ATA) statement on outpatient thyroidectomy[9], with the important difference that the ATA also includes total thyroidectomy.

The key criterion relies upon the definition of which thyroidectomies can be 'safely' undertaken as a day-case. The objective would be to identify patients at lower risk rather than no risk, bearing in mind that postoperative haemorrhage may, in the most severe of events, be followed by a hypoxic brain injury or even death after tens of minutes rather than hours, if prompt intervention is not implemented[10].

The UKRETS is uniquely positioned to provide the best available information on thyroid surgery in the UK. The aim of this study was to analyse UKRETS to investigate the occurrence and risk factors for post-thyroidectomy haemorrhage in relation to the BAETS recommendation regarding day-case thyroid surgery.

Methods

This was a retrospective observational cohort study using data from the UKRETS. Patients undergoing thyroid surgery were included from the inception of the database on 28 June 2004 to 28 June 2018 (a 14-year period). Exclusions included patients younger than 18 years or older than 100 years, entries from surgeons with fewer than 10 operations in the database, operations other than total thyroidectomy or hemithyroidectomy, and all patients with missing data in the primary outcome of interest (reoperation for bleeding) (*Fig. 1*).

UKRETS database

The UKRETS database is provided by BAETS for its members and maintained by Dendrite Clinical Systems (Reading, UK). Data entry is by individual surgeon members, and encompasses surgical procedures on thyroid, parathyroid, adrenal glands and the endocrine pancreas occurring in the UK. Members are consultant surgeons, but the registration differentiates between grade of operating surgeon. It captures a growing number of patients undergoing endocrine surgery and currently represents in excess of 50 per cent of operations occurring in England when compared with data from Hospital Episode Statistics. Compliance is mandatory for members, and in England is used to inform trust executives of their employees' surgical volume, but regulatory powers are limited. Currently, data validation is not undertaken or subject to external auditing.

Study variables

The factors assessed for risk of reoperation for bleeding following thyroidectomy are summarized in *Table 1*, along with the completeness of data after applying exclusion criteria. Node dissection included hemithyroidectomy or total thyroidectomy accompanied by formal dissection of any of the cervical lymph node levels and central node dissection. Goitre type was either cervical or retrosternal (defined as extension to the thoracic inlet or below). Energy source refers to the use of vessel-sealing technology other than monopolar or bipolar cautery. The database does not record information on the use of antiplatelet or anticoagulation medication before surgery. Surgeon monthly rate was defined as the total number of thyroid operations/date of final entry – date of first entry in months. Surgeon monthly volume was categorized into groups of fewer than two, two to four, four to eight, and more than eight operations.

Study outcomes

Postoperative haemorrhage was defined as any return to the operating theatre for bleeding. The timing of reoperation is not a specified data field in UKRETS. Readmission was defined as any return to hospital for inpatient care related to thyroidectomy after discharge. The reason for readmission is not specified in UKRETS, although there are free-text boxes for additional clinical information, where this may be entered. Hypocalcaemia was

Table 1 Missing thyroidectomy data in UK Registry of Endocrine and Thyroid Surgery after applying exclusion criteria

Data field	No. of data entries in UKRETS (2004–2018)	Completeness of data (%)
Reoperation for haemorrhage	52 838	100.0
Sex	52 815	100.0
Thyroid status at presentation	51 906	98.2
Goitre type	39 692	75.1
Redo surgery	52 335	99.0
Energy source	45 219	85.6
Pathology	43 028	81.4
Primary surgeon	52 332	99.0
Hypocalcaemia	52 231	98.9

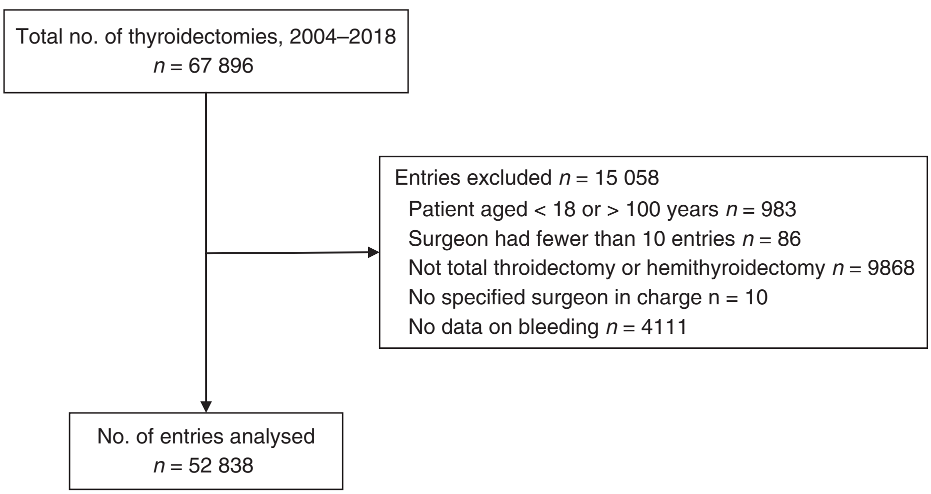

Fig. 1 Flow diagram of entries for thyroidectomy in the UK Registry of Endocrine and Thyroid Surgery, with reasons for exclusion from the study

defined as a serum corrected calcium level below 2.1 mmol/l or ionized calcium level of less than 1.2 mmol/l on the first postoperative day. Thyroid pathology was defined as the primary recorded pathology and did not take into account incidental secondary pathology. Mortality was recorded if this occurred as an inpatient after surgery.

Statistical analysis

Univariable analysis of the risk of bleeding for each of the independent variables was performed (*Table S1*), and a decision on which of these variables to include in the multivariable analysis was made based on their influence on risk of bleeding and completeness of data entry in UKRETS, to minimize the risk of bias. This step was necessary owing to the high rates of missing data for certain variables in UKRETS. Multivariable analysis of risk factors for reoperation for bleeding, readmission and mortality was then undertaken after excluding any remaining missing data entries for the variables included in each analysis.

Statistical analysis was performed with IBM SPSS® software version 25 (IBM, Armonk, NY, USA). The χ^2 test was used for categorical variables, and the independent *t* test for continuous variables. Binary logistic regression analysis with reoperation for bleeding, readmission or mortality as the dependent variable was undertaken with those independent variables included in the multivariable analysis. When two independent variables were closely correlated, such as thyroid cancer and node dissection, both were excluded in the multivariable analysis. Estimation of the variation in bleeding risk from predictive factors in the multivariable analysis was analysed by Nagelkerke as well as Cox and Snell methods. Differences were considered statistically significant at $P < 0.050$.

Results

A total of 67 896 thyroidectomies were recorded in UKRETS over the 14-year study interval. After applying the exclusion criteria, 52 838 entries were analysed, representing 77.8 per cent of thyroid operations in the registry (*Fig. 1*). Overall, the rate of missing data for thyroidectomy was thus 22.2 per cent. Most missing data were in the pathology, goitre type and use of energy device data fields in UKRETS (*Table 1*). Of the included patients, 33 290 underwent hemithyroidectomy and 19 548 had a total thyroidectomy. The number of thyroidectomies recorded in the database per annum increased with time (*Fig. S1*).

Univariable analysis of independent risk factors of reoperation for bleeding demonstrated that retrosternal goitre, hyperthyroidism at presentation, male sex, total thyroidectomy, patient age and surgeon monthly operation rate were significantly associated with risk of reoperation for bleeding (*Table S1*). As use of vessel-sealing technology and primary thyroid pathology showed no significant association with bleeding risk and there were large amounts of missing data in these fields in UKRETS, these variables were not included in the subsequent multivariable analyses. As goitre type was significantly associated with risk of bleeding, it was included in the subsequent multivariable analyses despite it having the largest amount of missing data.

The overall reoperation rate for bleeding after thyroidectomy was 1.2 per cent (449 of 39 014 patients in the multivariable analysis). The rate of reoperation for bleeding remained fairly constant over the study interval (*Fig. S1*). Of the 275 surgeons who contributed thyroid data to UKRETS over the study period 106 (38.5 per cent) recorded a reoperation for bleeding. The number of surgeons recording multiple operations for bleeding declined with increasing number of reoperations for bleeding recorded (*Fig. 2a*). Twenty-three (8.4 per cent) of the 275 BAETS surgeons recorded more than five reoperations for bleeding.

Male sex, increasing age, retrosternal goitre, redo surgery, and total thyroidectomy correlated significantly with an increased risk of reoperation for bleeding in multivariable analysis (*Table 2*). In contrast, node dissection and hyperthyroidism at presentation showed no significant correlation with risk of bleeding. Binary logistic regression predicts the likelihood, or odds ratio (OR), that a specific variable (predictor such as sex) will result in a particular outcome (for example, reoperation for bleeding) compared with the probability that it will not. Male sex (OR 1.76 (95 per cent c.i. 1.44 to 2.16), total thyroidectomy (OR 1.88, 1.52 to 2.33), redo surgery (OR 1.59, 1.17 to 2.17), retrosternal goitre (OR 1.41, 1.13 to 1.77) and increasing age (OR1.01, 1.00 to 1.02) all increased the risk of bleeding (*Table 2*). Surgeon monthly rate (OR 0.96, 0.93 to 0.99) and principal surgeon being a consultant (OR 0.77, 0.60 to 0.99) were associated with a decreased risk of bleeding. The risk of bleeding increased with increasing age (*Fig. 2b*).

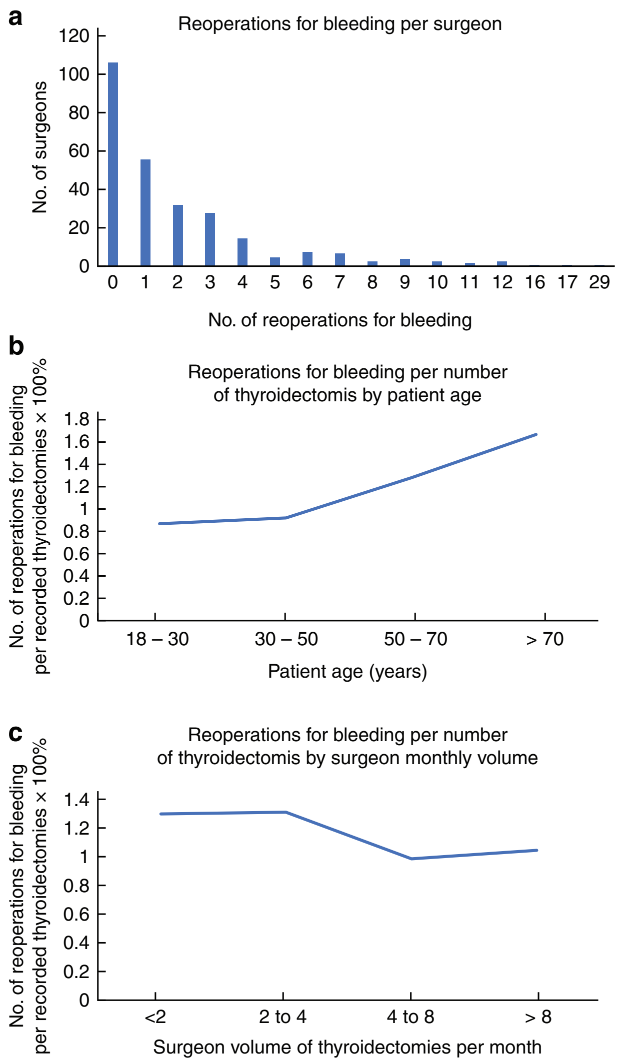

Fig. 2 Reoperations for bleeding recorded in the UK Registry of Endocrine and Thyroid Surgery per surgeon and as a proportion of the number of thyroidectomies by patient age and surgeon monthly volume

a Number of reoperations for bleeding recorded in UKRETS per surgeon, and as a proportion of the number of thyroidectomies by **b** patient age and **c** surgeon monthly volume.

Table 2 Multivariable analysis of risk factors for reoperation for bleeding after all thyroidectomies, readmission after thyroidectomy, and mortality after thyroidectomy

	Reoperation for bleeding after thyroidectomy		Readmission after thyroidectomy		Mortality after thyroidectomy	
Risk factor	Odds ratio	P	Odds ratio	P	Odds ratio	P
Male sex	1.76 (1.44, 2.16)	<0.001	1.24 (1.01, 1.51)	0.036	0.87 (0.33, 2.25)	0.768
Patient age	1.01 (1.00, 1.02)	0.001	1.00 (1.00, 1.01)	0.302	1.08 (1.05, 1.12)	<0.001
Hyperthyroidism at presentation	1.27 (0.96, 1.68)	0.089	1.24 (0.72, 1.12)	0.069	1.88 (0.51, 6.98)	0.344
Redo surgery	1.59 (1.17, 2.17)	0.003	1.00 (0.74, 1.37)	0.985	0.40 (0.05, 3.10)	0.382
Total thyroidectomy	1.88 (1.52, 2.33)	<0.001	1.30 (1.05, 1.61)	0.017	1.29 (0.51, 3.23)	0.594
Surgeon monthly rate	0.96 (0.93, 0.99)	0.015	1.01 (0.98, 1.56)	0.545	0.93 (0.79, 1.09)	0.343
Primary surgeon a consultant	0.77 (0.60, 0.99)	0.042	1.17 (0.90, 1.05)	0.241	2.88 (0.38, 21.66)	0.305
Node dissection	1.07 (0.79, 1.45)	0.661	1.02 (0.78, 1.32)	0.909	6.26 (2.44, 16.05)	<0.001
Retrosternal goitre	1.41 (1.13, 1.77)	0.003	1.30 (1.06, 1.60)	0.012	2.10 (0.89, 4.98)	0.092
Reoperation for bleeding	n.a.	–	4.13 (2.85, 5.98)	<0.001	2.72 (0.36, 20.78)	0.366
Hypocalcaemia on day 1 after surgery	n.a.		4.64 (3.80, 5.67)	<0.001	n.a.	–

Values in parentheses are 95 per cent confidence intervals. n.a., Data not available.

Estimation of the variation in risk of bleeding from predictive factors in this multivariable analysis resulted in low pseudo-R^2 values of 0.025 (Nagelkerke) and 0.003 (Cox and Snell).

Fig. 2c shows the risk of reoperation for bleeding after thyroidectomy by surgeon volume. There was a trend to a lower risk of bleeding with increasing surgeon volume, with the highest risk of reoperative bleeding seen in surgeons performing fewer than four operations per month.

Risk factors for hospital readmission and mortality were also analysed by multivariable logistic regression (Table 2). Readmission occurred after 1.7 per cent of thyroidectomies (599 of 34 291), and male sex, surgeon monthly operation rate, retrosternal goitre, total thyroidectomy, reoperation for bleeding, and hypocalcaemia were significantly correlated with readmission. Male sex (OR 1.24), retrosternal goitre (OR 1.30), total thyroidectomy (OR 1.30), reoperation for bleeding (OR 4.13) and hypocalcaemia (OR 4.64) increased the risk of readmission, whereas surgeon monthly rate (OR 0.93) decreased risk of readmission. Death occurred after 0.1 per cent of thyroidectomies (23 of 38 740). Patient age (OR 1.08) and node dissection (OR 6.26) were the only significant risk factors for mortality in multivariable analysis. Death occurred a mean of 21 (median 13, range 0–103) days after surgery. Of the 23 deaths, only one was in the group of patients who had reoperation for bleeding, although in two patients neck haemorrhage without reintervention was documented in the additional free-text comments. Other additional free-text comments were recorded in a further 10 patients, and included sepsis in either the neck, mediastinum or lungs (8 patients), disseminated malignancy (1 patient) and myocardial infarction (1). The patient who died after reoperation for bleeding suffered hypoxic brain injury. Clearly, with such a wide spread of mortality causes, the analysis of risk factors should be interpreted with caution.

Most thyroid operations currently performed as a day case in the UK are hemithyroidectomies, so a separate analysis of risk factors for reoperation for bleeding was undertaken in this subset of patients. Of a total of 24 700 patients who had a hemithyroidectomy over the study interval, reoperation for bleeding occurred in 217 (0.9 per cent). Risk factors for reoperation for bleeding in the hemithyroidectomy group included male sex (OR 1.75), patient age (OR 1.01) and redo surgery (OR 1.81). Increasing surgeon monthly rate was associated with a reduced risk of bleeding (OR 0.99) (Table 3). In comparison, reoperation for bleeding occurred in 1.6 per cent of total thyroidectomies (232 of 14 315), for which male sex (OR 1.73), hyperthyroidism at presentation (OR 1.38) and retrosternal goitre (OR 1.54) were the only risk factors (Table 4).

Readmission occurred in 1.2 per cent of hemithyroidectomies (261 of 21 967). Risk factors for readmission after hemithyroidectomy included male sex (OR 1.15) and redo surgery (OR 1.04). Increasing surgeon monthly operation rate was associated with reduced readmissions (OR 0.93) (Table 3). Death occurred in 0.04 per cent of patients undergoing hemithyroidectomy (10 of 24 554); risk factors were age (OR 1.12), node dissection (OR 5.43) and hyperthyroidism at presentation (OR 11.00). No deaths occurred in the reoperation for bleeding group, and all deaths were in patients operated on by a consultant surgeon as principal operator following hemithyroidectomy (Table 3).

Discussion

This study sought to analyse postoperative bleeding with a view to assessing the feasibility of safe day-case thyroid surgery in the UK.

The observed incidence of reoperation for bleeding following thyroidectomy was 1.2 per cent, consistent with results from other population and institutional series[1,11–13] and comparing favourably with that of 2.7 per cent found in a recent systematic review[14]. Potential factors associated with post-thyroidectomy bleeding are related to many different patient-specific, pathological, surgical and environmental characteristics, some of which are captured by the UKRETS database. Male sex, older age, redo surgery and retrosternal goitre, identified as risk factors, have also been reported by other authors and are well accepted[1,2,15]. Others[13] have identified thyroid cancer as a risk factor for postoperative bleeding, but this was not observed in the present cohort in univariable analysis. The number of missing points in this data field prevented the inclusion of thyroid cancer in the multivariable analysis.

These data show that thyroid surgeons with a higher volume have better outcomes for bleeding, in agreement with previous studies[14], but only for hemithyroidectomy and not after total thyroidectomy. This is consistent with a previous analysis[11] of UKRETS, which showed no association between risk of bleeding and surgeon volume for total thyroidectomy. The reason why risk of bleeding is associated with surgeon volume for hemithyroidectomy but not for total thyroidectomy is not clear. The higher bleeding rates were observed in surgeons undertaking fewer than

Table 3 Multivariable analysis of risk factors for reoperation for bleeding after hemithyroidectomy, readmission after hemithyroidectomy, and mortality following hemithyroidectomy

	Reoperation for bleeding after hemithyroidectomy		Readmission after hemithyroidectomy		Mortality after hemithyroidectomy*	
Risk factor	Odds ratio	P	Odds ratio	P	Odds ratio	P
Male sex	1.75 (1.31, 2.35)	<0.001	1.15 (0.95, 1.40)	0.156	0.75 (0.16, 3.57)	0.719
Patient age	1.01 (1.01, 1.02)	0.003	1.00 (0.99, 1.01)	0.797	1.12 (1.06, 1.18)	<0.001
Hyperthyroidism at presentation	0.61 (0.19, 1.90)	0.391	1.93 (1.57, 2.38)	<0.001	11.00 (2.22, 54.60)	0.003
Surgeon monthly rate	0.99 (0.90, 0.99)	0.020	0.93 (0.90, 0.96)	<0.001	0.89 (0.71, 1.11)	0.309
Redo surgery	1.81 (1.29, 2.55)	0.001	1.04 (0.78, 1.39)	0.782	0.65 (0.08, 5.42)	0.689
Primary surgeon a consultant	0.79 (0.56, 1.10)	0.165	1.20 (0.93, 1.55)	0.153	n.a.	–
Node dissection	0.80 (0.44, 1.45)	0.463	1.59 (1.24, 2.03)	<0.001	5.43 (1.09, 27.18)	0.039
Retrosternal goitre	1.35 (0.96, 1.91)	0.082	1.48 (1.21, 1.81)	<0.001	n.a.	–
Reoperation for bleeding	n.a.	–	4.53 (3.08, 6.66)	<0.001	0	0.997

Values in parentheses are 95 per cent confidence intervals. *None recorded in 'principal operator consultant' or 'reoperation for bleeding' group. n.a., Data not available.

Table 4 Multivariable analysis of risk factors for bleeding after total thyroidectomy in 232 reoperations for bleeding recorded after 14 315 total thyroidectomies

Risk factor	Odds ratio	P
Surgeon monthly rate	0.98 (0.93, 1.02)	0.286
Male sex	1.73 (1.30, 2.30)	<0.001
Patient age	1.01 (1.00, 1.02)	0.062
Hyperthyroidism at presentation	1.38 (1.02, 1.87)	0.035
Reoperation	0.99 (0.44, 2.26)	0.989
Primary surgeon a consultant	0.75 (0.51, 1.10)	0.135
Nodal dissection	1.26 (0.44, 2.26)	0.218
Retrosternal goitre	1.54 (1.14, 2.09)	0.005

Values in parentheses are 95 per cent confidence intervals.

four thyroidectomies per month, suggesting that day-case thyroidectomy for low-volume thyroid surgeons may not be appropriate[9].

The extent of thyroid surgery appears to correlate well with a post-thyroidectomy risk of bleeding, with total thyroidectomy being associated with a higher risk of postoperative bleeding and hospital readmission, but not mortality. Risk factors included increasing age, male sex and redo surgery. This increased risk of bleeding with patient age for both hemithyroidectomy and total thyroidectomy could be due to a combination of increasing use of anticoagulants, age-related co-morbidity and frailty, none of which is documented routinely in UKRETS.

Reoperation for bleeding greatly increased the risk of hospital readmission, as would be expected, but did not significantly increase the risk of death after thyroidectomy. Hospital readmission occurred in only 1.7 per cent of patients, a much lower rate than that reported from US administrative data sets (11.7 per cent)[13,16] and in a systematic review (8.7 per cent)[14], but is comparable with individual case series[12]. Unsurprisingly, total thyroidectomy had a higher risk of readmission, as a higher risk of postoperative complications, in particular hypocalcaemia, is more common following total thyroidectomy[17].

Much overlap was found with the recent meta-analysis by Liu and colleagues[18], which reported on 25 studies (424 563 patients) that included the overall rate of bleeding (1.5 per cent), and found risk factors associated with an increased risk of post-thyroidectomy haemorrhage to be male sex, older age, Graves' disease, redo and bilateral thyroid surgery. Unlike that meta-analysis, neck dissection was not found in the present study to be a demonstrable risk factor for bleeding[18]. Quimby and coworkers [19] also performed a similar meta-analysis of 11 studies; only Graves' disease had an increased risk of postoperative bleeding (pooled OR 1.58, 95 per cent c.i. 1.09 to 2.31; $P = 0.02$).

Of note, the low pseudo-R2 values in this study suggests that only a small proportion of the variation in risk was dependent on the predictive factors analysed; thus, the occurrence of bleeding was dependent on factors that were not analysed, which may or may not be measurable. Therefore, postoperative bleeding was not completely predictable from the variables evaluated.

It was not possible to compare the outcomes from day-case and inpatient thyroidectomy in this cohort because intent to perform surgery as a day case is not recorded in UKRETS. Whether the management of patients who had bleeding as inpatients and those who had bleeding as outpatients in the first 24 h after surgery can be considered equivalent remains questionable. The majority of reports with large numbers of patients are based on inpatient cohorts, but there are increasing data on ambulatory thyroid surgery emerging. Most data have come from high-volume centres in the USA, where ambulatory thyroid surgery is practised widely, with comparable results to those for inpatient thyroidectomy[20]. The meta-analysis by Lee *et al.*[21] identified fewer complications in the outpatient group (relative risk (RR) 0.56, 95 per cent c.i. 0.37 to 0.83). The study found no difference in readmission/reintervention rates (RR 0.60, 0.33 to 1.09) and no significant difference in the rate of postoperative haemorrhage in the inpatient group compared with the outpatient group (0.4 *versus* 0.7 per cent; $P = 0.245$). These findings suggest excellent patient selection and surgery, given that the rates of bleeding were less than half of those in UKRETS. The absence of mortality following thryoidectomy in the outpatient group is an important finding[21]. One important caveat is that the definition of hospital discharge can, in some cases, mean discharge to a second-tier, low-intensity healthcare facility, or hotel with nursing care, rather than home. These facilities do not exist in the UK, but may present a stimulus for the development of innovative models of postoperative care delivery. US data are also not representative of all US surgeons. The report by Tuggle and colleagues[16] of 7000 patients in New York State undergoing thyroidectomy showed that only 16 per cent were ambulatory, significantly more operations were hemithyroidectmies, and the majority were done by high-volume surgeons.

Overall, recent worldwide literature on day-case thyroidectomy has reported rates of post-thyroidectomy readmission, reoperation, haemorrhage and mortality that are similar, if not higher, than the present findings. This suggests that day-case thyroidectomy is feasible and appropriate, in selected UK patients. As outlined and reviewed in detail by the ATA Statement on Outpatient Thyroidectomy[9], the feasibility of day-case thyroid surgery is complex and should be guided by preoperative, intraoperative and postoperative patient, centre and surgeon characteristics. The development and adoption of evidence-based clinical protocols, pathways and checklists that formalize patient triage and minimize known risk factors may help with the implementation of safe ambulatory thyroid surgery in the UK. Observing features such as patient preference, co-morbidity, presence of extensive thyroid/neck disease, appropriate social setting, and proximity to a healthcare facility is essential[9]. Specific discharge requirements should include absence of neck haematoma, and ability to swallow and follow postoperative instructions. Before hospital discharge, patients should be observed for a minimum period of time, as most postoperative bleeding occurs within 6 h of the procedure[9]. Similar protocols for day-case thyroidectomy that have incorporated these principles successfully have already been reported and applied with excellent outcomes in the UK[8].

Financial pressures on the NHS will inevitably drive a shift to performance of day-case thyroidectomy. The key issue for a service selecting patients for ambulatory thyroid surgery is identification of the lowest-risk patients who meet the additional geographical and social criteria. A no-risk scenario is not possible, so risk management requires an understanding that, as suggested by the low pseudo-R^2 value in the multivariable analysis of bleeding risk, the majority of variability in risk of bleeding is independent of the variables analysed in the present study. In other words, there is a 'known unknown' of preoperative or intraoperative variables, which either have not or cannot easily be measured and may predict a post-thyroidectomy bleed. As postoperative bleeding cannot be eliminated, access to timely medical intervention is paramount.

A limitation of this study is that a significant proportion (22.2 per cent) of records were excluded from the analysis. Despite legitimate concerns about the quality of non-validated UKRETS data, this registry remains best positioned to quantify any concerns regarding post-thyroidectomy haemorrhage. A further limitation of this analysis is that the occurrence of 'postoperative haematoma' is determined by the recording of a 'reoperation for bleeding' in UKRETS. This is not always the case, as a haematoma may also occur that is managed conservatively, presumably because it does not threaten the airway, is not considered amenable to successful surgical intervention, or the patient is not deemed suitable for further surgical intervention.

Based on this study and associated data, a male patient of advanced years with co-morbidities, receiving anticoagulant or antiplatelet agents, with Graves' disease, and requiring reoperative surgery or total thyroidectomy for retrosternal goitre, who experiences postoperative hypertension is the amalgam of the higher-risk patient[2,15,22]. Patients who do not have any of these features are at a lower, albeit poorly predictable, risk of postoperative bleeding. Therefore, if an appropriately selected patient with minimal risk factors undergoes hemithyroidectomy by a high-volume surgeon in a setting with the appropriate infrastructure and protocols, the risk of an adverse outcome from ambulatory thyroid surgery has been mitigated to a level of acceptability, and is supported by BAETS.

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Supplementary material

Supplementary material is available at *BJS* online.

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