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ORIGINAL SCIENTIFIC REPORT

Risk Score of Neck Hematoma: How to Select Patients for Ambulatory Thyroid Surgery?

Nathalie Chereau[1,2] · Gaelle Godiris-Petit[1] · Severine Noullet[1] · Sophie Di Maria[3] · Sophie Tezenas du Montcel[4] · Fabrice Menegaux[1,2]

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Abstract

Background The risk of postoperative compressive hematoma is the major limitation for a wide development of ambulatory thyroidectomy (AT). The aim of this study was to establish a risk score of hematoma on the basis of preoperative criteria.

Methods All patients who underwent thyroidectomy between 2002 and 2017 were reviewed in a high-volume endocrine surgery center. Multivariate analysis of risk factors associated with hematoma was performed in lobectomy and total thyroidectomy (TT). We assigned the risk factors identified by multivariate analysis weighted points proportional to the regression coefficient values. A simple sum of all accumulated points for each patient calculated the total score.

Results For lobectomy [31 hematoma among 3912 patients (0.8%)], the weighted points of Vit K antagonist (VKA) were 3 (OR 9.86), and 1 in male gender (OR 2.4). For TT [162 hematoma among 13,903 patients (1.2%)], the weighted points of VKA were 4 (OR 12.18), 1 in male gender (OR 1.89), and 1 for diabetes (OR 1.86). Other factors weighted 0 in both groups. A total score >1 was linked to a risk of hematoma > 1.3% for lobectomy or TT. AT should not be proposed to any patient under VKA, and in case of TT, to male patients with diabetes. Prospectively, patients had AT from May 2018 to February 2020, 529 patients underwent ambulatory TL (483) or TT (46) and only one patient experienced neck hematoma.

Conclusion We established a simple and reproducible predictive score of early discharge for lobectomy and TT that could be useful for patients' management.

✉ Nathalie Chereau
nathalie.chereau@aphp.fr

[1] Department of Endocrine and Digestive Surgery, Hospital Pitié Salpêtrière, AP-HP, Sorbonne University, 47-83 Boulevard de l'Hôpital, 75013 Paris, France

[2] Groupe de recherche clinique n: 16 Thyroid Tumors, Sorbonne University, Paris, France

[3] Department of Anesthesiology, Hospital Pitié Salpêtrière, AP-HP, Sorbonne University, 75013 Paris, France

[4] INSERM, Institut Pierre Louis d'Epidemiologie et de Santé Publique, Hospital Pitié Salpêtriere, APHP, Sorbonne University, 75013 Paris, France

Introduction

Outpatient surgery is defined as same-day discharge from a surgical unit, not requiring an overnight hospital stay. However, patient comfort and safety are paramount after any kind of surgery. Thyroid surgery is theoretically a good candidate for outpatient surgery since it is not very painful. However, thyroid surgery carries some specific outcomes (nerve injury, hypocalcemia) and it exposes the patient to the risk of neck hematoma and airway compromise.

Outpatient thyroidectomy has become increasingly popular [1], with several peer-reviewed reports of safe implementation [2, 3]. Not all thyroidectomy procedures can be managed on an outpatient basis, and it is essential to identify patients and procedures for which it is reasonable [4].

In April 2018, in our institution, we opened a pavilion exclusively dedicated to ambulatory surgery and decided to seize this opportunity to start a program for outpatient thyroidectomy. The aim of this study was to explain how we started and which safeguards we used establishing criteria involving patient, thyroid disease and extent of surgery, medical facilities, and social factors to make outpatient thyroidectomy safe and feasible. For that purpose, we created a risk score of neck hematoma from a 16-year database for the selection of patients eligible for ambulatory surgery on the basis of preoperative criteria and then applied this score in a series of consecutive patients.

Materials and methods

Retrospective study and creation of the score

All records of patients who underwent thyroid lobectomy (TL) or total thyroidectomy (TT, including completion thyroidectomy) between January 1, 2002, and December 31, 2017, were reviewed to evaluate the risk of postoperative neck hematoma requiring surgical reexploration (excluding subcutaneous bruising). All patients who provided informed consent prior to surgery were included in the institutional database. We separated TL and TT since hematoma is less frequent and less compressive after a TL than after a TT. Univariate and multivariate analyses of preoperative variables were performed to create the score. We reported all preoperative parameters that have been suggested in the literature to increase the risk for hematoma formation: demographic characteristics, including patient age, sex, body mass index, vitamin K antagonist (VKA) therapy or any oral anticoagulant, antiaggregants, arterial hypertension, diabetes, sleep apnea, hyperthyroidism, malignancy, weight of the resected thyroid gland, and operative details, including extent of thyroid surgery and, when needed, lymph node dissection (LND).

Before opening our ambulatory surgery center (ASC), we discussed with anesthesiologists what would be the eligibility criteria for outpatient thyroidectomy. We also defined with the nursing staff what will be needed before, during and after the surgical procedure. The first step was a close partnership between the outpatient thyroidectomy team and the patient. Information looked essential and was used to begin the patient's consultation with the surgeon. This information was repeated during the anesthesiologist's consultation and by the nursing staff before surgery. After surgery, a phone call was made on POD1 from the nurses' team to the patient to determine if everything was fine.

Operative technique: The surgical procedure was standardized. Thyroidectomy was performed under general anesthesia, with medication to control the patient's nausea and vomiting, and included procedures to minimize coughing during emergence. Recurrent laryngeal nerves (RLNs) were identified and followed along their entire cervical course (on each side for a TT), and special care was taken to preserve the superior parathyroid glands. Any parathyroid gland that could not be preserved because of its anatomic location was minced and grafted into a sternocleidomastoid muscle. For patients with recurrent thyroid disease, completion thyroidectomy was performed through the previous cervical scar and followed the same principles as for total thyroidectomy in one step. Patients with a preoperative or intraoperative diagnosis of thyroid carcinoma had an additional lymph node dissection. Collagen pads were left in the thyroid bed on both sides, and no suction drainage systems were left [5–8]. Then, surgical specimens were submitted to pathological examination.

Postoperative management: Patients were authorized to drink water just after emergence. Indirect laryngoscopy was performed in patients with dyspnea, hoarseness, or loss of voice quality. The serum calcium concentration was assessed on POD1 and repeated on POD2 if the first result was less than 2 mmol/L. Both perioperative calcium and vitamin D supplementation were proposed to prevent symptomatic or deep hypocalcemia following TT.

After identification of the population eligible for ambulatory thyroidectomy, we tested our scoring system in patients who needed thyroid surgery, starting with lobectomy. All patients with 0–1 point (risk of hematoma less than 2%) were proposed for ambulatory surgery. We performed a retrospective analysis of data from 529 patients operated for ambulatory TL or TT from May 2018 through February 2020. All patients who provided informed consent prior to surgery were included in the dataset. Data were collected prospectively. Selection of patients for ambulatory group necessarily required clinical judgment based on assessment social patient-specific (inadequate

family/friend support, unable to follow postop instructions…).

Statistical analysis

Univariate and multivariate logistic regression model were used to identify predictive factors of hematoma requiring surgical reoperation. Multivariate analysis was performed to create a risk score of hematoma, using a backward stepwise logistic regression model that included all variables, with a P value of less than 0.05 in univariate analysis. The results of this multivariate analysis are shown as odds ratios (95% confidence intervals). We assigned the risk factors identified by multivariate analysis with weighted points proportional to the regression coefficient values (rounded to the nearest integer). A simple sum of all accumulated points for each patient is used to calculate the score. A risk of hematoma greater than the upper limb off the 95% CI was considered incompatible with outpatient management.

Results

Retrospective study

Thyroid lobectomy (TL)

From 2002 to 2017, 4376 TLs were performed in our institution. A total of 464 patients were excluded for completion thyroidectomy. Ultimately, 3912 patients were included in the study.

Details about the overall study population are given in Table 1.

Predictive factor analysis of neck hematoma

Thirty-one patients (0.8%, 95% CI [0.5–1.1%]) were reoperated for hematoma, with a median delay of 2 h. In univariate analysis (Tables 1, 2), factors were significantly associated with the risk of hematoma: male sex ($p = 0.003$) and VKA ($p = 0.0001$). In multivariate analysis, these 2 factors remained independent.

TL score

TL scores ranged from 0 to 4, according to the presence and the weight of risk factors (Table 3). The rates of hematoma after lobectomy ranged from 0.5 to 9.1% for a score of 0 to 4, respectively (Fig. 1). As the upper limb of the 95% CI was over 2.2%, patients with a score ≥ 3 (risk of hematoma $> 1.3\%$), i.e., patients with AVK, would be excluded for ambulatory lobectomy.

Total thyroidectomy (TT)

During the study period, we performed 13,903 TT. One hundred sixty-two patients (1.2%, 95% CI [1.0–1.4%]) were reoperated for neck hematoma, with a median delay of 2 h. In univariate analysis (Table 4), 8 factors were significantly associated with risk of hematoma: male sex

Table 1 Univariate analysis of preoperative risk factors associated with hematoma in patients who underwent lobectomy

Variable	Total ($n = 3912$)	No hematoma ($n = 3881$)	Hematoma ($n = 31$)	p value
Male	**990 (25%)**	**975 (25%)**	**15 (48%)**	**0.0031**
Age	48.3 ± 14.9	48.3 ± 14.9	49.1 ± 15.8	0.7601
Age ≥ 65 (Old patient)	587 (15%)	581 (15%)	6 (19%)	0.4522
BMI	24.9 ± 4.9	24.9 ± 4.8	25.1 ± 6.7	0.8781
Obesity (BMI ≥ 30)	511 (13%)	506 (13%)	5 (17%)	0.5851
Hyperthyroidism	381 (10%)	377 (10%)	4 (13%)	0.5372
Vit K antagonist	**64 (1.6%)**	**59 (1.5%)**	**5 (16.1%)**	**0.0001**
Aspirin	219 (6%)	216 (6%)	3 (10%)	0.2499
Hypertension	637 (16%)	629 (16%)	8 (26%)	0.1466
Diabetes	200 (5.1%)	198 (5.1%)	24 (6.5%)	0.6713
Sleep apnea	46 (1.2%)	45 (1.2%)	1 (3.2%)	0.3081
Malignancy	696 (17.8%)	692 (17.8%)	4 (12.9%)	0.4749
Lymph node dissection	458 (11.7%)	456 (11.7%)	2 (6.5%)	0.3608

BMI: body mass index (kg/m^2); data are in N (%) or means (± SD: standard deviations)

Bold values are statistically significant for $p < 0.05$

Table 2 Multivariate analysis of preoperative risk factors associated with hematoma in patients who underwent lobectomy

Variable	OR (95% confidence interval)	*p* value	Points in the score
Sex (Male)	2.40 (1.17–4.96)	0.0176	1
VitK antagonist	9.86 (3.58–27.15)	<0.0001	3

Table 3 Risk scores of hematoma for ambulatory lobectomy

Score	Nb of patients		% hematoma	95% CI	
	N	%		Inf.	Sup.
0	2890	73.9	0.48	0.27	0.81
1	956	24.5	1.26	0.65	2.18
3	31	0.8	6.45	0.79	21.4
4	33	0.8	9.09	1.92	24.3

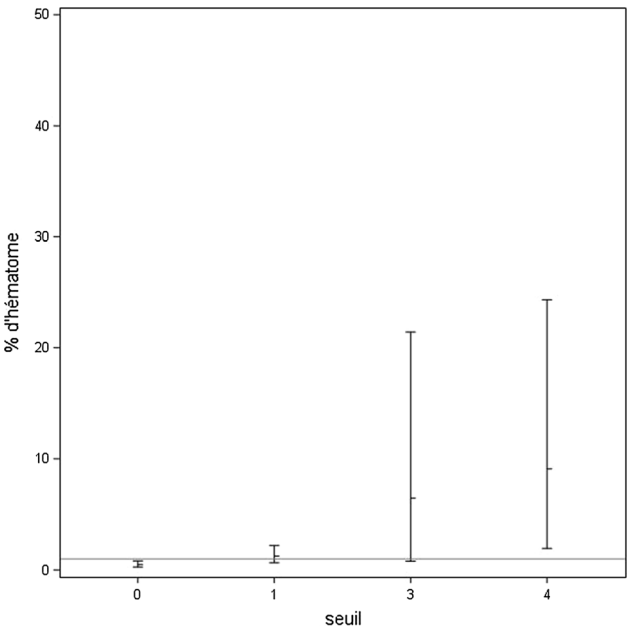

Fig. 1 Rate of hematoma after lobectomy according to the score

($p < 0.0001$), patient age $\geq$ 65 years ($p = 0.003$), hyperthyroidism ($p = 0.01$), arterial hypertension ($p < 0.0001$), diabetes ($p < 0.0001$), sleep apnea ($p = 0.005$), antiaggregant therapy ($p = 0.008$), and VKA ($p < 0.0001$). In multivariate analysis, 3 factors remained independent: male sex, VKA, and diabetes (Table 5).

TT score

TT scores ranged from 0 to 6, and a score > 1 was incompatible with outpatient management since the upper limb of the 95% CI risk of hematoma was over 1.7% (Table 6) (Fig. 2). This finding indicates that males with VKA and/or diabetes should have TT with an overnight hospitalization.

Validation of the score and ambulatory thyroidectomy

All patients with a score $\leq$1 were considered compatible with outpatient management.

From May 17, 2018, to February 28, 2020, 529 patients underwent ambulatory TL (483) or TT (46) including 30 completion thyroidectomy. One patient experienced neck hematoma 4 h after TL and returned to the OR in the ambulatory surgery center for evacuation of his hematoma. Six patients (1%) needed to stay one night: 3 because of vomiting, one after a reintervention for hematoma and 2 because of unforeseen lack of companion person for the return. Eight patients (2%) had a transient RLN palsy after TL. Two transient postoperative hypocalcemia (4%) was observed in the group of patients with TT.

Discussion

The risk of compressive cervical hematoma is the most significant barrier to expanding AT. Other postoperative complications can occur, but they are not life-threatening. This is the reason why we chose to focus on the risk of neck hematoma. In our experience, this risk was very low (1%), but not zero. This emphasizes the importance of the selection of patients who will be candidates for AT. The development of an AT program should be the result of a long and extensive reflection involving surgeons, anesthesiologists and nursing staff in a team that is well aware of its own complication rate [9–11].

The frequency of compressive cervical hematoma is low, approximately 1% [12], but its consequences can be tragic since asphyxia may result in cerebral anoxia with major neurologic sequelae or death. Most hematomas occur within 6 h of the thyroidectomy, but delays of over 6 h

Table 4 Univariate analysis of preoperative risk factors associated with hematoma in patients who underwent total thyroidectomy

Variable	Total (n = 13,903)	No hematoma (n = 13,741)	Hematoma (n = 162)	p value
Male	2765 (20%)	2706 (20%)	**59 (36%)**	<0.0001
Age	51.2 ± 14.3	51.2 ± 14.3	53.0 ± 15.5	0.1204
Age ≥ 65 y (Old patient)	2511 (18%)	2467 (18%)	**44 (27%)**	0.0025
BMI	25.6 ± 5.1	25.6 ± 5.1	26.0 ± 5.4	0.3227
Obesity (BMI ≥ 30)	2442 (18%)	2413 (18%)	29 (18%)	0.929
Hyperthyroidism	3591 (26%)	3535 (26%)	**56 (35%)**	0.0106
Vit K antagonist	246 (1.8%)	215 (1.6%)	**31 (19.1%)**	<0.0001
Aspirin	977 (7%)	957 (7%)	**20 (12%)**	0.0078
Hypertension	2995 (22%)	2938 (21%)	**57 (35%)**	<0.0001
Diabetes	937 (6,7%)	913 (6,7%)	**24 (14.8%)**	<0.0001
Sleep apnea	227 (1,6%)	219 (1,6%)	**8 (4.9%)**	0.0052
Malignity	4237 (30%)	4201 (31%)	**36 (22%)**	0.0217
Lymph node dissection	3302 (24%)	3278 (24%)	**24 (15%)**	0.0072

BMI: Body Mass Index. Data are in N (%) or Means (± SD: standard deviations)

Bold values are statistically significant for $p < 0.05$

Table 5 Multivariate analysis of preoperative risk factors associated with hematoma in patients who underwent total thyroidectomy

Variable	OR (95% confidence interval)	p value	Points in the score
Male	1.89 (1.36–2.64)	0.0002	1
Vit K antagonist	12.18 (7.96–18.63)	<0.0001	4
Diabetes	1.86 (1.18–2.94)	0.0073	1

Table 6 Risk scores of hematoma for ambulatory total thyroidectomy

Score	Nb of patients		% hematoma	95% CI	
	N	%		Inf.	Sup.
0	10,367	74.6	0.82	0.66	1.01
1	3006	21.6	1.23	0.87	1.69
2	278	2.0	3.24	1.49	6.06
4	123	0.9	5.69	2.32	11.4
5	106	0.8	18.9	11.9	27.6
6	17	0.1	23.5	6.8	49.9

have been reported in up to 47% of cases [13–15]. However, as was noted in the ATA statement, there are no reports in any recent American studies of such a high rate of delayed hematoma [11]. Therefore, it is reasonable to consider a 6-h delay after the end of surgery to let the patient go home if there are no clinical signs suggesting the onset of a cervical hematoma (increase in neck volume or upper airway dyspnea). Although no consensus exists today as to the selection criteria for AT [16], onset circumstances and factors favoring cervical hematoma are better known. Prevention has improved, and better control of nausea, vomiting, and elevated blood pressure has certainly lowered the risk of hematoma. Definitions of contraindications are also mandatory, and we believe that there should be differences between TL and TT for the exclusion criteria for an outpatient procedure. Our score is efficient and secure: only patients with antivitamin K therapy should be excluded from ambulatory TL or TT, and specifically diabetic males scheduled for TT (even without antivitamin K therapy) should also be excluded, leaving a large proportion of patients who can have ambulatory thyroidectomy with a reasonable risk of hematoma, less than 1.2%.

Other early postoperative complications should also be checked, and if possible, prevented. Postoperative monitoring is essential. Among clinical signs of postoperative cervical hematoma, recurrent nerve palsy (voice alteration, dyspnea, difficulty swallowing liquids), or hypocalcemia in case of bilateral thyroidectomy (paresthesias, carpopedal spasm, or tetany) should be checked repeatedly. Prophylactic oral administration of calcium (postoperatively) and

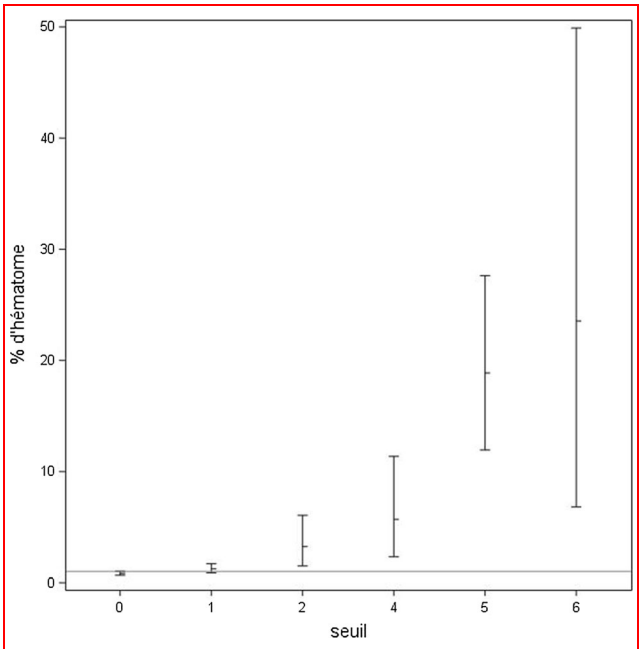

Fig. 2 Rate of hematoma after total thyroidectomy according to the score

vitamin D (alfacalcidol, preoperatively) has been proposed for preventing postoperative hypocalcemia after TT.

Discharge criteria following ambulatory thyroidectomy are important to respect [11]. The scar should be carefully checked, with special attention paid to eliminate neck swelling and trouble swallowing (essentially for liquids), speaking or breathing. Pain should be controlled on oral medications, and the team should ensure that the patient understood what surgery was done and that he could safely go back home with mobile communication facilities, including during the trip home.

One criticism that could also be given is that this score is not very restrictive, but the risk of neck hematoma is very low, especially when simple and few contraindications are respected. Our results show that the risk for postoperative hematoma needing reoperation remains around 1%. The use of this preoperative risk score does not allow to decrease this complication rate observed in this observational study. Another limitation is that we did not demonstrate that our score was validated for TT since we had only a few bilateral thyroid resections in our study.

There is no consensus in the literature, with very few statements. The British Association of Endocrine Surgeons [9, 10] and The American Thyroid Association (ATA) [11] are extremely prudent and insist on the difficulties in establishing the selection criteria for AT. While some of these series have not identified any risk factors [15], others have identified factors such as male gender, age over 50, cancer, extent of thyroid resection, completion total thyroidectomy, lymphadenectomy, substernal goiter, or surgeon experience [13–21]. Use of anticoagulation medication, hyperthyroidism, Graves' disease, and thyroiditis has also been identified as risk factors [19]. Moreover, other promoting factors for hematoma include cough, hypertensive episodes, and vomiting. Patients with serious medical comorbidities and active bleeding disorders should be excluded from outpatient management [20]. Patient motivation is a major issue, and nonmedical contraindications should be eliminated, i.e., difficult communication (non-native speaking patients), a long and difficult journey between home and the surgical facility (long distance, urban traffic), absence of emergency transportation or familial or social isolation. Therefore, we believe that starting an ambulatory thyroidectomy program should be progressive and cautious, and that, before performing outpatient TT, ambulatory TL should be proposed as a routine procedure and validated by the medical (surgeons and anesthesiologists) and nursing teams.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Informed consent Informed consent was obtained from all individual participants included in the study. All patients who provided informed consent before surgery were included in the institutional database.

Human and animal rights This study has been approved by the appropriate institution review board (IRB).

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