

Consequences of bleeding after thyroid surgery – analysis of 7805 operations performed in a single center

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Abstract

Introduction: Surgical treatment of thyroid gland diseases is associated with the possibility of severe complications. The most dangerous of them is bleeding. Current studies focus on its risk factors, rather than reoperation-related consequences.

Material and methods: We analyzed 7805 thyroid operations performed from 1996 to 2014 in the Clinic of General, Gastroenterological and Endocrine Surgery of Wrocław Medical University. Typical risk factors, symptoms and consequences of bleeding were analyzed.

Results: Among operated patients 88.2% were female and 11.8% male. Bleeding occurred in 84 (1.08%) patients. Sex ($p = 0.006$), preoperative thyroid pathology ($p = 0.03$), and type of operation ($p < 0.001$) are significant risk factors for bleeding, while retrosternal goiter and surgeon's experience are not. Risk of bleeding is highest in the case of male sex, toxic goiter and total resection of the thyroid gland. Most reoperations took place within 6 h. In 88.8% of cases of this kind of complication the surgeon indicated the exact source of bleeding; most commonly it was the neck muscles, skin and subcutaneous tissue, or the thyroid stump. Three patients required a second reoperation, 24 suffered further complications, and 8 required transfer to the Intensive Care Unit (ICU). Cardiac arrest occurred in 3 patients and 2 suffered bilateral vocal cord palsy.

Conclusions: Bleeding after thyroid operations is a direct life threat that requires immediate intervention. As a result death may occur, half of patients suffer other complications and some require intensive care. The risk is highest in the case of male sex, toxic goiter and total resection of the thyroid gland. Each patient after thyroid surgery needs to be closely observed. An operating theatre and ICU should be available at all times.

Key words: thyroidectomy, outcomes, complications, bleeding, reoperation.

Introduction

Surgical treatment of thyroid gland diseases is associated with the possibility of severe postoperative complications, such as recurrent laryngeal nerve palsy, superior laryngeal nerve injury, parathyroid insufficiency and bleeding. Both vocal cord palsy and hypoparathyroidism can undoubtedly decrease the patient's quality of life; bleeding, however, is genuinely life-threatening and requires immediate surgical intervention. Bleeding after a thyroidectomy is in itself a severe complication, and reoperation due to bleeding may entail further complications, including death.

According to the available literature, the incidence of bleeding after thyroid gland surgery varies from 0% to 4.2% [1–9]. The rate is related to a given center's experience, as shown in a Dutch study in which the frequency of bleeding ranged from 1.9% to 14.3% in different hospitals [10]. However, in highly experienced departments the rate usually does not exceed 1% [11, 12].

The majority of studies on bleeding after thyroid operations focus on finding and analyzing risk factors. The indications for the primary procedure (the type of thyroid disease), the scope of the operation, the patient's age and sex, as well as the individual surgeon's experience are analyzed in such studies. Understanding risk factors is essential, as it allows surgeons to decrease the incidence of this dangerous complication. On the other hand, there are very few studies concerning the consequences of the bleeding itself and the associated reoperation. The authors of this paper therefore decided to focus on these subjects, and whether bleeding after thyroidectomy should really be feared.

Table I. Bleeding after thyroid operations in years 1996–2014

Year	Thyroid operations	Number of bleeding cases, n (%)
1996	261	–
1997	183	4 (2.19)
1998	213	1 (0.47)
1999	430	4 (0.93)
2000	333	2 (0.60)
2001	423	3 (0.71)
2002	469	8 (1.71)
2003	395	3 (0.76)
2004	452	2 (0.44)
2005	490	5 (1.02)
2006	382	6 (1.57)
2007	399	2 (0.50)
2008	447	9 (2.01)
2009	380	2 (0.53)
2010	410	3 (0.73)
2011	496	6 (1.21)
2012	539	4 (0.74)
2013	555	15 (2.70)
2014	548	5 (0.91)
Total	7805	84 (1.08)

Material and methods

We retrospectively analyzed 7805 thyroid operations due to various pathologies, performed from January 1996 to December 2014 – a total of 19 years' experience. All the patients were treated in the Clinic of General, Gastroenterological and Endocrine Surgery at Wrocław Medical University (Wrocław, Poland), which is a highly specialized surgical center that has focused on thyroidectomy for decades. The operations were performed by highly experienced surgeons as well as surgical residents.

In this 19-year period we observed a gradual shift in the scope of the procedures, especially in patients undergoing surgery for multinodular goiter. Two decades ago most of these patients underwent subtotal bilateral thyroidectomy, but now most of them undergo total resection of the thyroid gland. In addition, in 2012 neuromonitoring of the recurrent laryngeal nerve was introduced in our clinic.

In the clinic it is a standard protocol to leave a suction drain after a thyroidectomy, which is removed 2 days later. Every patient that has had neck surgery is closely observed and monitored for at least 2 h, then most of them are transferred to the general surgical ward, where a nurse checks the patient's condition every hour. In cases of additional risk, the monitoring period is prolonged to 12 h. The standard hospitalization time after thyroid surgery is 48 h.

The patients' data – age, sex, pre- and postoperative diagnosis, type of procedure, complications, performing surgeon – were stored in the clinical database. Typical risk factors were analyzed, as well as time from skin closure to reoperation due to bleeding, symptoms that suggested neck hematoma and the consequences (both immediate and remote) of the bleeding itself.

Statistical analysis

For the statistical analysis, *p*-values were calculated by the χ^2 test and Spearman's rank correlation test.

Results

Epidemiology and risk factors for bleeding among patients undergoing thyroid surgery

From 1996 to 2014, 7805 patients were operated on due to various pathologies of the thyroid gland at the Clinic of General, Gastroenterological and Endocrine Surgery (Tables I and II). Among them, 6884 (88.2%) were female and 921 (11.8%) were male. The mean age was 50 ± 13 years.

Bleeding occurred in 84 patients, i.e., 1.08% of all those who underwent thyroid surgery. Among

Table II. Demographic and intraoperative characteristics of 7805 patients included in the study

Demographic characteristics	Number of all patients N = 7805 (100%)	Number of patients with bleeding after thyroidectomy N = 84 (100%)	Percentage of all operated patients (1.08%)	P-value
Age, mean ± SD [years]	50 ±13	54 ±16		
Gender, n (%):				0.006
Female	6884 (88.2)	66 (78.6)	(1.0%)	
Male	921 (11.8)	18 (21.4)	(2.0%)	
Thyroid pathology, primary operation, n (%):				0.03
Nodular goiter	5426 (69.5)	49 (58.3)	(0.90%)	
Toxic nodular goiter	934 (12.0)	15 (17.9)	(1.61%)	
Graves-Basedow disease	406 (5.2)	8 (9.5)	(1.97%)	
Toxic adenoma	125 (1.6)	4 (4.8)	(3.20%)	
Thyroid cancer	398 (5.1)	5 (6.0)	(1.26%)	
Inflammatory goiter	119 (1.5)	0 (0.0)	(0%)	
Other (adenoid cell carcinoma, lymphoma)	8 (0.1)	0 (0.0)	(0%)	
Secondary thyroid operations (reoperation/recurrent goiter), n (%)	389 (5.0)	3 (3.6)	(0.77%)	0.03
Retrosternal goiter, n (%)	1626 (20.8)	24 (28.6)	(1.48%)	0.08
Type of operation, n (%):				< 0.001
Lobectomy	329 (4.2)	3 (3.6)	(0.91%)	
Bilateral subtotal	5684 (72.8)	47 (56.0)	(0.83%)	
Dunhill procedure	1086 (13.9)	13 (15.5)	(1.20%)	
Total thyroidectomy	618 (7.9)	19 (22.6)	(3.07%)	
Other procedures (cytoreduction)	88 (1.1)	2 (2.4)	(2.27%)	

the patients with bleeding, there were 66 (78.6%) females and 18 (21.4%) males. In relation to the overall number of patients operated on, there was a statistically significant difference in bleeding rates: 2.0% in males and 1.0% in females ($p = 0.006$). The median age of the patients with bleeding was 54 ±16 years; the youngest was 22 and the oldest 84 years old.

We observed a statistically significant increase in bleeding throughout the study period ($p = 0.03$). However, there is no significant correlation between the bleeding rates and time ($p = 0.25$) – Figure 1. More operations entail more bleeding, while the rate of bleeding remains relatively constant.

The amount of bleeding in relation to particular thyroid pathologies is shown in Table II. It can be seen that bleeding occurred most often in the group of patients operated on due to toxic goiter: toxic adenoma (3.20%), Graves-Basedow disease (1.97%) and toxic multinodular goiter (1.61%).

Bleeding was less likely after operations due to thyroid cancer (1.26%), multinodular goiter (0.90%) and recurrent goiter (0.77%). We observed no bleeding after operations for inflammatory goiter. There are statistically significant differences between the bleeding rates in the presented groups ($p = 0.03$). Goiter toxicity seems to be the greatest risk factor for postoperative bleeding.

Among the patients reoperated on because of bleeding, 24 (28.6%) had retrosternal goiter. Comparing this to the overall number of patients with retrosternal goiter (1626), we concluded that is not a statistically significant risk factor for bleeding ($p = 0.08$) – Table II.

Bleeding in relation to the scope of the operation is presented in Table II. Total resection of the thyroid gland was associated with the greatest risk of bleeding (3.07%). The risk was also high (2.27%) in palliative procedures (cytoreduction, tracheostomy, surgical biopsy of unresectable tumors). Lobectomy (0.91%), bilateral subtotal

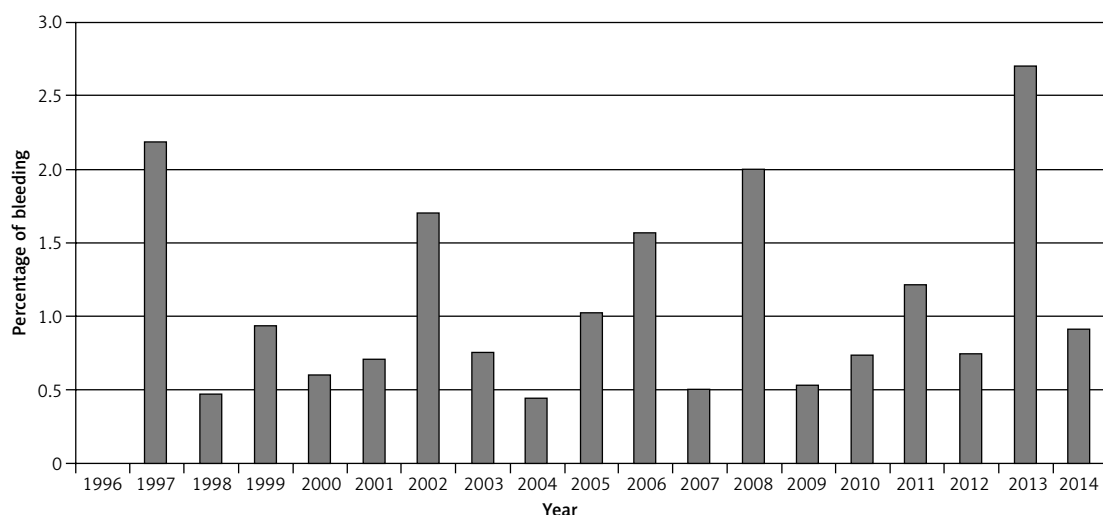


Figure 1. Amount of bleeding after thyroid operation in relation to all thyroid operations (mean = 1.08%)

thyroidectomy (0.83%) and Dunhill procedure (1.20%) were less likely to cause bleeding. There is a strong ($p < 0.001$) statistical correlation between the scope of the operation and the risk of subsequent bleeding.

The surgeon's experience was not a significant risk factor for postoperative bleeding. It should be emphasized that all surgical residents at our clinic always perform thyroidectomies under the close supervision of an experienced surgeon.

Consequences of bleeding after thyroid surgery

The time from skin closure after primary surgery to reopening due to bleeding varied from 10 min to 24 h. Most reoperations took place within 6 h after the primary procedure. One female patient, however, was reoperated on 22 days after thyroidectomy because of a large hematoma. Probably the first symptoms of bleeding developed about 7 days after surgery, but the patient came back to the surgical unit only when she felt severe pressure around her neck, accompanied by dyspnea.

Symptoms of bleeding reported by patients

In our study patients reported the following symptoms that suggested bleeding: increase of neck circumference: 41 (48.8%), dyspnea: 46 (54.8%), pressure on the neck: 73 (86.9%), dysphagia: 5 (5.9%), blood on the postoperative dressing: 30 (35.7%), low blood pressure: 10 (11.9%), volume of suction drain contents exceeding 150 ml: 20 (23.8%). In every patient with postoperative bleeding there was more than one symptom.

Intervention due to diagnosed bleeding

Eighty-three (98.8%) bleeding patients were reoperated on in the surgical theater, and in 1 (1.2%)

case the intervention took place in the patient's bed due to acute respiratory distress. In 4 (4.8%) patients there were significant difficulties with intubation; as a result in 1 (1.2%) case a laryngeal mask airway was used, and 3 (3.6%) patients with severe trachea compression needed their skin stitches released and the hematoma evacuated before successful intubation.

Sources of bleeding

In 88.8% of the cases of postoperative bleeding it was possible to identify the exact source; in the rest (11.2%) the surgeon could not establish the origin of the bleeding. Table III presents all the sources. In 10 cases there were two sources, and in two cases there were three separate sources of bleeding.

Three (3.6%) patients required a second reoperation due to recurrences of bleeding.

Complications associated with bleeding and reoperation

We observed complications associated with bleeding and reoperation in 24 (28.6%) patients. Eight of them (9.5%) required transfer to the intensive care unit (ICU) after reoperation. Significant blood loss occurred in 7 (8.33%) patients, who needed blood transfusions (2 to 4 units of packed red blood cells).

The most severe complication was cardiac arrest, which we observed in 3 (3.57%) patients. In one of them, cardiac arrest occurred as a result of acute respiratory failure before revision of the postoperative wound. She was successfully resuscitated, reoperated on and finally transferred to the ICU. In the second patient, cardiac arrest occurred just after wound revision; she was also successfully resuscitated and transferred to the ICU.

The third one was an 80-year-old man who underwent palliative resection (cytoreduction) due to anaplastic thyroid cancer. In his case cardiac arrest occurred during wound revision due to severe bleeding that the surgeon was not able to control. The patient was diagnosed with disseminated intravascular coagulation (DIC) and unfortunately died during reoperation, despite intensive resuscitation and transfusion of more than four units of packed red blood cells.

One (1.2%) female patient was diagnosed with cerebral stroke after revision, and another (1.2%) with transient ischemic attack (TIA).

Severe bilateral vocal cord palsy was observed in 2 (2.4%) female patients. The first one was primarily operated on due to a large retrosternal toxic goiter. Soon after the operation, postoperative hematoma with significant pressure on the trachea was diagnosed. As a result, there were significant problems with intubation and iatrogenic fractures of the laryngeal cartilages occurred. This initial diagnosis was confirmed by videofiberoptic examination. The patient was then treated with glucocorticoid injections and vocal cord rehabilitation, and did not require tracheostomy. Six months after the laryngeal trauma she regained normal vocal cord motility.

Bilateral recurrent laryngeal nerve palsy also occurred in the previously mentioned 69-year-old patient who was admitted 22 days after a thyroidectomy with a postoperative hematoma. Immediately after her first surgery and before discharge from the hospital, an ENT specialist confirmed normal vocal cord function. After her second admission the patient was reoperated on and a large (5 cm × 6 cm × 4 cm) fibrotic hematoma was removed from the postoperative bed, but vocal cord motility did not return instantly. Nine months after reoperation, the patient regained function of a single vocal cord, while the other is permanently paralyzed.

Table III presents a list of the complications associated with bleeding and reoperation in the analyzed patients.

Discussion

Although the thyroid gland has both a rich vascular supply and high blood perfusion, bleeding after thyroidectomy occurs more often than after other surgical procedures. The surgeon should always provide adequate hemostasis before skin closure, whether possible risk factors for bleeding are present or not. We agree with Morton *et al.* [13] that a postoperative Valsalva maneuver is a good, commonly used practice for evaluating hemostasis before wound closure. There are surgical centers that perform a Trendelenburg tilt as well [14], but this has never been done in our clin-

Table III. Origins of bleeding and complications associated with bleeding and reoperation

Bleeding after thyroid surgery	N = 84 (100%)
Origin of bleeding identified during reoperations:	
Skin and subcutaneous tissue	18 (18)
Neck muscle/strap muscles and sternocleidomastoid muscle	18 (18)
Thyroid stump	18 (18)
Trachea	11 (13.1)
Branches of thyroid arteries	11 (13.1)
Thyroid pole	7 (8.3)
Thyroid bed	4 (4.7)
Not identified or many origins	11 (13.1)
Complications associated with bleeding and reoperation:	
Cardiac arrest	3 (3.57)
Cerebral stroke	1 (1.19)
TIA	1 (1.19)
Bilateral vocal cord palsy	2 (2.38)
Unilateral vocal cord palsy	3 (3.57)
Parathyroid insufficiency	28 (33.33)
Death	1 (1.19)

ic. There is no universal consensus on using drains after thyroidectomy. In our clinic they are routinely used after every thyroid operation, but there is no clinical study that statistically proves drainage beneficial, as shown in the meta-analysis carried out by Kennedy *et al.* [15]. In addition, the authors of that study pointed out that there is no scientific basis for recommending routine drainage after thyroidectomy, and it is even possible that the presence of a drain increases the rate of postoperative bleeding [15]. In our experience drainage often allows bleeding to be diagnosed sooner, thus hastening reoperation and decreasing the likelihood of other postoperative complications.

Knowledge of the risk factors and potential consequences of bleeding for a patients' quality of life is essential in thyroid surgery. Some studies have analyzed many risk factors but found that none of them has a statistically significant influence [1–4, 7, 16]. In our analysis, the patient's sex, preoperative diagnosis and the scope of the operation were found to be significant risk factors. Bleeding occurs more often in males (2% vs. 1%; $p = 0.006$), as in a study by Caló *et al.* [17]. Bleeding is much more frequent after total resections than after partial ones ($p < 0.001$) [9, 10, 18]. The type of preoperative thyroid pathology also influ-

ences the rate of bleeding [10]; the risk is highest in toxic goiter ($p = 0.03$). Most of the hemostatic abnormalities associated with thyroid dysfunction are the consequences of direct effects of thyroid hormones on the synthesis of various hemostatic factors. Moreover, thyroid autoimmunity may also modify the processes of primary and secondary hemostasis. Hyperthyroidism is generally associated with hypercoagulability and hypofibrinolysis. However, further, larger studies are required. Retrosternal goiter ($p = 0.08$) and the surgeon's experience are not significant risk factors for bleeding.

Other authors have indicated age as a significant risk factor [19], and have also looked for other, less specific factors with potential prognostic value. Morton *et al.* [13] identified elevated systolic blood pressure (over 150 mm Hg) as such a factor. The negative effects of hypertension in the postoperative period are also emphasized by Caló *et al.* [17]. Basto *et al.* observed that bleeding occurs less often when patients receive ketoprofen after surgery [20]. Proper postoperative care – maintaining optimal blood pressure, appropriate analgesia, prevention of postoperative nausea and vomiting (PONV), managing coexisting chronic conditions – are as important for a good outcome as the procedure itself [21, 22]. In a study by Bononi *et al.*, bleeding was related to PONV [23].

It is important to regard bleeding itself as a risk factor for subsequent complications. In our material about half of the patients that had postoperative bleeding suffered another complication (e.g., cardiac arrest or stroke) and 9.5% of them required transfer to the ICU after revision. Mortality due to bleeding and reoperation in our study group was 1.19% (one death out of 84 patients with bleeding), which was higher than in the study by Promberger *et al.* (3 deaths out of 519 patients with bleeding = 0.58%) [9]. Two (2.4%) patients in our study suffered bilateral vocal cord palsy. Fortunately, neither of them required tracheostomy, while other authors described such a necessity in 1.7% of cases [9]. However, there was another severe iatrogenic complication in our material, namely fracture of the laryngeal cartilages during a difficult intubation (1 patient). The use of neuro-monitoring allowed us to distinguish this mechanical laryngeal trauma from intraoperative damage to the recurrent laryngeal nerve.

Most authors confirm the importance of careful monitoring during the first 6 h after thyroid surgery [19]. Special attention should be paid to such alarming symptoms as dyspnea, neck edema, a feeling of pressure and an unusual amount of blood in the suction drain. Thus monitoring for at least 24 h after a thyroidectomy seems justified. The case of our patient who was taking anticoagulants and developed a neck hematoma 7 days after surgery suggests that high risk pa-

tients should be instructed to observe their necks even after discharge from the hospital. A female patient, suffering from type 2 diabetes and arterial hypertension, was undergoing anticoagulant treatment (acenocoumarol 4 mg *p.o.* once a day) due to permanent atrial fibrillation. International normalized ratio (INR) values were within the therapeutic range. Five days before thyroidectomy acenocoumarol was discontinued and fractionated heparin (nadroparin 0.6 ml *s.c.* once a day) was applied instead. After a successful operation, on the second postoperative day we switched back to acenocoumarol, monitored by INR values. We admit that such management could have increased this patient's risk for postoperative bleeding and neck hematoma. In such patients adequate treatment of coexisting chronic conditions is of great importance.

Bleeding after thyroid surgery is still significant and is often associated with severe complications [24, 25]. Diagnosed in time, it can be managed with a good outcome, while delayed intervention may cause subsequent life-threatening complications [17].

In conclusion, bleeding after thyroidectomy is a direct life threat that requires immediate intervention. As a result of bleeding, death may occur (1.19%); about half of the patients suffer other complications; and 9.5% of them require intensive care. Male sex, toxic goiter and total thyroidectomy are statistically significant risk factors for postoperative bleeding, while retrosternal goiter and the surgeon's experience are not. Every patient after thyroid surgery needs to be closely observed by experienced doctors and nurses. Immediate intervention in the operating theater and access to the ICU should be available at all times.

Conflict of interest

The authors declare no conflict of interest.

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