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RISK FACTORS FOR POSTOPERATIVE HEMORRHAGE IN THYROID SURGERY

FAKTORI RIZIKA ZA POJAVU POSTOPERATIVNE HEMORAGIJE U HIRURGIJI ŠTITASTE ŽLEZDE

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Abstract

Post-thyroidectomy bleeding is rare but potentially life-threatening complication. The incidence of post thyroidectomy bleeding ranges from 0.43 to 4.2%. Despite developments in surgical techniques, postoperative bleeding is still the most serious complication in thyroid surgery because it represents an emergency condition, in most cases.

A number of different risk factors have been reported in studies evaluating the occurrence of postoperative hematoma. Risk factors range from those related to patients' demographics, thyroid pathology, extent of resection, previous thyroid surgery, to those related to the presence of co-morbidities, or use of anticoagulant or antiplatelet medications. Postoperative hemorrhage is a rare event, therefore studying the risk factors associated with this complication is challenging. Risk factors for hematomas are still largely debatable considering that most of the studies were conducted in single centers.

Early recognition and emergency intervention are essential in managing post-thyroidectomy hemorrhage. Therefore, it is especially important to identify risk factors, as well as the time frame for the occurrence of this complication.

Keywords:
thyroidectomy, complications, postoperative hemorrhage, risk factors

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Sažetak

Postoperativno krvarenje je retka ali ozbiljna komplikacija u hirurgiji štitaste žlezde. Incidencija postoperativne hemoragije se kreće od 0,43 do 4,2%. Uprkos unapređenju hirurške tehnike, postoperativno krvarenje ostaje najznačajnija komplikacija u hirurgiji štitaste žlezde jer predstavlja urgentno i životno ugrožavajuće stanje.

Mnoge studije prikazuju različite faktore rizika za pojavu postoperativnog krvarenja u hirurgiji štitaste žlezde, od onih koji se odnose na samog pacijenta, osnovno oboljenje štitaste žlezde, obim hirurške resekcije, prisustvo recidivantne bolesti, do onih koji se odnose na prisustvo različitih komorbiditeta, kao i upotrebu antikoagulantne i antiagregacione terapije. Niska incidencija ove komplikacije predstavlja poteškoću u evaluaciji mogućih faktora rizika. Budući da je većina studija koje se bave evaluacijom faktora rizika za pojavu ove komplikacije sprovedena u pojedinačnim centrima, faktori rizika su i dalje diskutabilni.

Rano prepoznavanje i brza reintervencija ključne su u zbrinjavanju postoperativnog hematoma. Zbog toga je veoma važno identifikovati faktore rizika, kao i vremenski okvir javljanja ove komplikacije.

Ključne reči:
tiroidektomija, komplikacije, postoperativno krvarenje, faktori rizika

Introduction

Thyroid surgery, as well as other surgical procedures, is associated with the risk of complications. The severity of complications has changed significantly during the time and with the advances in surgical technique. In modern thyroid surgery, the most common and the most important complications are injuries of the recurrent laryngeal nerves and parathyroid glands (1).

In the nineteenth century, thyroid gland surgery was considered not only complicated but also dangerous, and most commonly, patients have died from bleeding and infections. The French Academy of Medicine recommended that thyroid surgery should be banned (2, 3). Diefenbach states that thyroid surgery is more dangerous than all other surgical procedures, and if it should not be banned, it should certainly be limited (4, 5).

Emil Theodor Kocher (1841 - 1917) was one of the pioneers of thyroid surgery and was the first surgeon to receive a Nobel prize for medicine. Kocher first recognized the importance of asepsis, and he improved the control of hemostasis in thyroid surgery. During ten-year period his overall operative mortality decreased from 15% to 2.4%. The surgical technique he established is still in use with certain modifications (6, 7).

In modern endocrine surgery, thyroidectomy is a very safe procedure, and in numerous series mortality rate approaches zero (8, 9). A profound knowledge of the central neck compartment anatomy and precise surgical technique are of the most importance for every surgeon practicing thyroid surgery. This way, most complications associated with the thyroidectomy can be minimized, or even avoided (10-12).

Although the morbidity associated with thyroidectomy has been reduced to a minimum, complications remain a concern, since thyroid gland diseases often occur in younger patients. Today, thyroid operations are mostly elective and conducted with the idea of achieving the best results in therapy, with as little risk of complications as possible (6, 8, 13).

Complications following thyroid surgery can be non-surgical or surgical. Non-surgical complications are described in 1 - 2% of operated patients. These complications are related to the underlying thyroid pathologies, other underlying diseases, as well as general anesthesia (8, 14). Surgical complications can be classified into early complications and late complications (**table 1**) (9, 15).

Table 1. Complications in thyroid surgery

Early complications	Late complications
Bleeding and hematoma	Persistent hypoparathyroidism
Residual hypothyroidism	Persistent hypothyroidism
Laryngeal nerve injuries	Recurrent hyperthyroidism
Transient hypoparathyroidism	Malignant alteration
Tracheal collapse	Keloid
Laryngeal edema	
Thyroid storm	
Seroma, infection, and dehiscence	

Bleeding and hematoma

Postoperative hemorrhage is rare but unpredictable complication of thyroid surgery despite advancements in surgical techniques, refinements in surgical instruments and better understanding of thyroid pathology (4, 5, 16, 17).

One of the essential goals in thyroid surgery is meticulous hemostasis. Intraoperative bleeding stains the surrounding tissue which can increase the risk of parathyroid gland and laryngeal nerve injury. Precise hemostasis also prevents potentially life-threatening postoperative hemorrhage (18).

The term "compressive hematoma" is most often used to describe the potential compromise of the airway that occurs because of postoperative bleeding. However, it seems that hematoma cannot cause tracheal compression significant enough to compromise the airway. What causes respiratory distress is laryngopharyngeal edema as a result of impairment in venous and lymphatic drainage (4, 18).

The incidence of postoperative hematoma ranges

from 0.43 up to 4.39% (4,5,9,17-23). The difference in reported incidence, in large series, results from the difference in the definition of postoperative hematoma. While some authors report the occurrence of all postoperative hematomas, the others report only symptomatic hemorrhage requiring surgical intervention.

The etiology of hematoma formation includes reopening previously cauterized blood vessels, bleeding from residual thyroid tissue and slipping of the ligatures (16,24).

The time interval after thyroidectomy, in which postoperative bleeding can occur is variable (23). There are studies describing the occurrence of postoperative bleeding several days after thyroidectomy (9,24,25). However, 80 to 90 percent of all postoperative bleeding occurs within the first 24 hours after thyroidectomy (26,27).

Risk factors for the occurrence of postoperative hematoma

Several studies have tried to identify the risk factors for post-thyroidectomy hematoma occurrence (28-31). So far, the results are conflicting. For every study showing an association of a certain factor with an increased risk of bleeding, there is usually at least one study finding no association (1).

Numerous risk factors have been identified and they can be classified into one of two large categories: factors that are related to the patient and factors that are related to the surgical procedure (**table 2**) (5,17,21-23,27-31,32). Preoperative control of risk factors that can be influenced, significantly affects the treatment outcome.

Tabela 2. Risk factors for postoperative hemorrhage in thyroid surgery

Risk factors related to the patient	Risk factors related to the surgical procedure
Demographic factors	**Extent of thyroidectomy**
Age	(Unilateral vs. bilateral)
Gender	
Body mass index (BMI)	**Retrosternal goiter**
Comorbidities	**Surgery for recidivant goiter**
Bleeding disorders	
Chronic renal failure	
Anticoagulant drugs	**Surgical technique**
Antiplatelet drugs	(Method of access, division of the strap
Thyroid pathology	muscles, method of closing the wound,
Malignant pathology	minimally invasive surgery)
Hyperthyroidism	
	Anesthesia related risk factors
	Postoperative retching and coughing
	Postoperative vomiting
	Postoperative hypertension

Patient related risk factors include age, gender, body mass index, factors related to underlying comorbidities, inherited, or acquired bleeding disorders, and factors related to thyroid pathology (malignant tumors, toxic goiters).

Risk factors that are related to the surgical procedure include: re-operative surgery, dissection for substernal goiter and the use of different surgical techniques. Also, it is known that the extent of surgery (unilateral, bilateral, neck dissection) can affect the occurrence of postoperative hemorrhage. Risk factors that are related to the anesthesiologic procedures include: coughing during extubating, post-operative vomiting, and hypertension most often due to postoperative pain (4,30).

Regarding the age as a risk factor, men are about 1.5 to 2 times at increased risk of developing postoperative hemorrhage than woman (21,26,30). In their study, Chen and collaborators state that male muscles are stronger and their contractions during extubating may provoke reopening of previously cauterized blood vessels or slipping of ligatures (34).

While in the studies of Godballe and Bergenfelz, elderly patients have a higher risk of bleeding, in the study of Leyre and collaborators, age is not a significant risk factor for the postoperative hemorrhage (21,26,30). In the Godballe's study, the relative risk of bleeding is 1.5 higher in patients older than 50 years.

Several large series have shown that patients with higher body mass index (BMI) are at greater risk of postoperative hemorrhage (20,35,36). Sun and collaborators, in their study from 2020, report that high BMI is an independent risk factor for postoperative bleeding complications, both in patients with benign and malignant pathology (37).

Patients with inherited or acquired bleeding diathesis have been considered a high-risk group for the occurrence of postoperative bleeding. However, thyroid gland operations are elective, and patients who have congenital or acquired hemorrhagic diathesis can be prepared to minimize the risk of intra and postoperative bleeding. Thus, patients with Willebrand's disease should be treated with desmopressin and patients with hemophilia should be compensated with coagulation factors. Patients on therapeutic antiplatelet or anticoagulation medication therapy should have these withheld preoperatively, if possible (1,2).

It is known empirically that certain thyroid pathology (malignant tumors, hyperthyroidism) carries a higher risk for postoperative hemorrhage. However, there is little evidence in the literature to support this belief.

In a large Danish study on 5400 patients, 230 patients developed postoperative hematoma, and malignant histology was independent risk factor for postoperative hemorrhage (21). In the Promberger's study, patients who had surgery for malignancy, had a higher risk of hematoma (50 of 2460 patients, 2.0%) (5) whilst in Burkey's study of 13817 patients only 42 had postoperative hematoma and no relationship between postoperative bleeding and malignant histology was found. Burkey's study was probably underpowered to detect a difference, since only nine of 42 patients with hematomas had malignant thyroid tumor (23).

Patients with hyperthyroidism are at increased risk of postoperative hemorrhage due to increased vascularization in toxic goiters (Mb. Graves, multinodular toxic goiter). Menegaux reported a postoperative bleeding rate of 15% in patients with hyperthyroidism 15% and 1.6% in euthyroid patients, which is a statistically significant difference (38). Despite well documented hypervascularity of toxic goiters, for every study reporting increased postoperative bleeding in hyperthyroid patients (19, 20, 39) there are usually a few large series finding no significant association (21-23).

In terms of risk factors related to surgical procedure, majority of the evidence is inconsistent. Extent of surgery (unilateral vs. bilateral, Dunhill's procedure, subtotal lobectomy) and re-operative surgery have been identified as risk factors for postoperative hemorrhage in some series, but not in others.

In the Godballe's study, bilateral surgery was identified as a risk factor for post-thyroidectomy hemorrhage, while re-do surgery was not (21). In a large study by Menegaux and collaborators, there was a difference in the rates of postoperative bleeding in patients who were operated for the first time for various thyroid diseases compared to those who were operated for recurrent thyroid disease (0.7% and 2.5%, respectively) (38). In the study by Burkey and collaborators, neither the operation due to recurrence nor the extent of the surgery were risk factors for occurrence of postoperative hematoma (23).

Samona and collaborators in their case control study from 2016, found that retrosternal goiters carried higher risk of post-thyroidectomy hematoma occurrence (40). Dehal et al. in a large nationwide study reported that thyroidectomy for retrosternal goiter was an independent risk factor for the postoperative hemorrhage (25). The larger dissection surface in substernal goiters may translate to increased hematoma formation.

Surgical technique plays an important role in preventing postoperative hemorrhage. The mode of access and closure of the wound must be considered. If the strap muscles have been cut instead of separated, this may serve as a source of potential post-operative hemorrhage. Sometimes the strap muscles have to be transected, particularly in cases where there is inflammation (in autoimmune diseases) or adhesions (in malignant tumors) (2, 4). Another potential source of bleeding are anterior jugular veins that can be injured during the closure of vertically divided muscles (23).

The decreased dissection in minimal access approaches may translate to decreased hematoma formation. Miccoli and collaborators in their first study of a minimally invasive video-assisted thyroidectomy, did not report the occurrence of postoperative bleeding in a series of 427 patients (41), while in a later study on 2698 patients, they reported an incidence of postoperative bleeding of 0.2% (42). In a series of patients operated on with a minimally invasive video-assisted method, Haitao et al. reported the incidence of bleeding of 0.5% (43). Cougard, in his preliminary series of patients operated using a totally endoscopic approach, did not report the occurrence of postoperative hematoma (44). Similarly, there was no hematoma in a series of endoscopic thyroidectomies for a solitary nodule (45).

And finally, anesthesia related factors can contribute to the prevention of postoperative hematoma. It is important that the patient is extubated smoothly without significant retching and coughing, if possible. It is also of vital interest to control postoperative pain and vomiting with appropriate medication. This way, rise in arterial or venous pressure can be avoided, which is important in minimizing the risk for post-thyroidectomy bleeding (46, 47).

Diagnosis, treatment and prevention of postoperative hematoma

Symptoms of postoperative hemorrhage range from pressure sensation in the neck to acute respiratory distress (44).

If the drain was not placed after thyroidectomy, the first sign of postoperative bleeding is pressure sensation and swelling of the neck. Further signs include pain, dysphagia, dyspnea or stridor, suture line bleeding and then agitation, confusion and sweating (4, 19, 20). If the drain has been placed, the first sigh of bleeding is significant drain tube losses.

It is particularly important to distinguish the bleeding in the visceral compartment of the neck from the bleeding in subcutaneous tissue. Deep hematomas are more likely to require surgical re-exploration. Ultrasound is difficult to interpret but may be useful in differentiating superficial from deep neck hematomas (**figure 1**) (16).

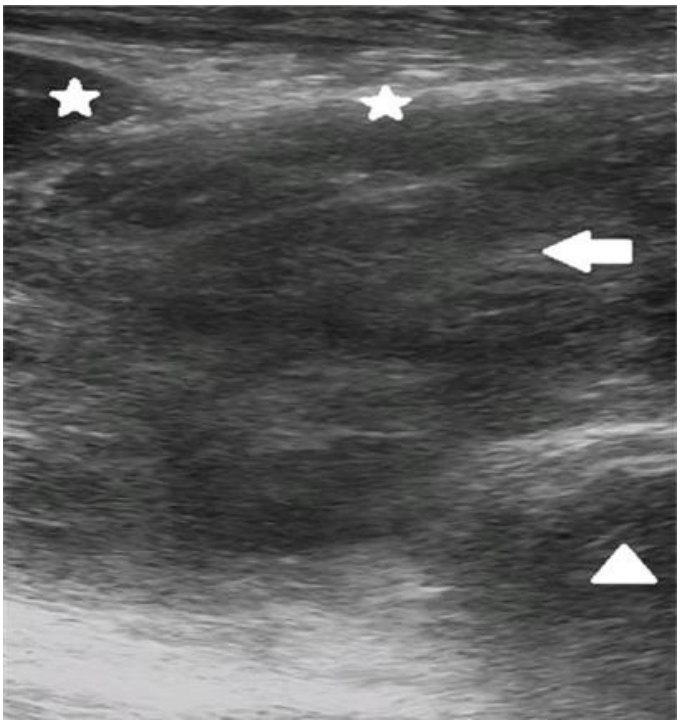

Figure 1. Ultrasound finding of a deep neck hematoma.
* strap muscles; ➔ hematoma; Δ trachea.

The first step in the management of a deep neck hematoma is to establish the patient's airway. It is particularly important to recognize the need for revision of the operative wound and to transport the patient to the operating room in time, where he will be intubated, and the re-exploration will be done under aseptic conditions. Sometimes, when respiratory distress is developing rapidly, it may be necessary to perform bedside evacuation of hematoma. If the patient's condition improves, i.e., the patient is no longer in respiratory distress, he should be transported to the operating room. It is rare and dramatic situation that the patient cannot be intubated even after bedside decompression of the wound. If the airway cannot be established via intubation, urgent tracheostomy may be needed (29, 31).

During the operative re-exploration, all bleeding sources should be identified. All remaining hematomas must be removed, and the wound irrigated. During surgical re-intervention, attention to parathyroid glands and laryngeal nerves remains paramount.

The key issue of prevention is precise hemostasis during thyroidectomy as well as attention to anatomical details. Prior to wound closure, Valsalva maneuver should be performed. It implies the elevation of intrapulmonary pressure to 40 mmHg which can enable recognition of any bleeding vessels. During thyroidectomy the patient can be put in a reverse Trendelenburg position and after thyroidectomy in semi-Fowler position. Both positions imply that the patient's head is elevated to keep a negative pressure in the veins.

Conclusion

Postoperative hematoma following thyroidectomy although uncommon remains very serious and potentially life-threatening complication. It seems that the use of new surgical techniques and technological innovations, do not contribute significantly to the reduction of the incidence of postoperative hemorrhage. Therefore, it is very important to study risk factors for the occurrence of postoperative bleeding and identify patients at risk.

In short, it seems that there is no alternative to careful hemostasis in the prevention of this complication. It is of vital interest to recognize early signs of bleeding and to react promptly once when the hematoma is identified.

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