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Review

Postoperative Bleeding after Thyroid Surgery: Care Instructions

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Abstract

Prospective studies on the incidence, etiology, and prognosis of well-characterized patients with bleeding after thyroid surgery are lacking. Bleeding after thyroid surgery cannot be predicted or prevented even if risk factors are known in every single procedure, which enhances the im-portance of the following issues: (a) meticulous hemostasis and surgical technique; (b) coopera-tion with the anesthesiologist, i.e., controlling the Valsalva maneuver, adequate blood pressure at the end of the operation as well as at extubation phase and (c) in case of bleeding, a prompt management to guarantee a better outcome. This requires an intensive postoperative clinical monitoring of patients, ideally, in a recovery room with trained staff for at least 4-6 h. Early recognition of postoperative bleeding with immediate intervention is the key to the management of this complication.

Keywords: Bleeding; postoperative complications; risk factors; thyroidectomy.

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Thyroid surgery has always been associated with a high risk of bleeding since its birth: "[…] *there is a grave risk of death from hemorrhage during thyroid operations and it is a procedure by no means to be thought of* […]" (Robert Liston (1794-1847), "[…] *thyroidectomy is one of the most thankless, and most perilous undertakings* […]" (Dieffenbach Johann Friedrich (1792-1847), "[…] *no sensible man will* […] *attempt to extirpate a goiter of the thyroid gland* […] *every step he takes will be environed with difficulty and every stroke of his knife followed by a torrent of blood and lucky will it be for him if his victims live long enough to enable him to finish his horrid butchery* […]" (Samuel D. Gross, 1805 -1884).

Blood flow through the thyroid gland is high (Table 1). Haemorrhage in general surgery can be classified into three main categories: (a) primary bleeding, i.e., bleeding that occurs within the intra-operative period.[1] This should be resolved during the operation, with any major haem-orrhages recorded in the operative notes, and the patient monitored closely postoperatively. (b) Reactive bleeding i.e., occurs within 24 hours of operation. Most cases of reactive haemorrhage are from a ligature that slips off or an unacknowledged vessel.[2] Often, these vessels are not recognized intraoperatively due to intraoperative hypotension and vasoconstriction; once the blood pressure falls back into a normal range postoperatively, the unacknowledged vessel will then start bleeding.[3] (c) Secondary bleeding i.e., occurs 7-10 days postoperatively. Secondary haemorrhage is often due to the erosion of a vessel from a spreading infection.[4] Secondary haemorrhage is most often seen when a heavily contaminated wound is closed primarily. The fo-

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Table 1. Blood flow rates (Ml/kg tissue min *min). The thyroid gland represent one of the highest blood rates in human body

Organ	Flow rates
Adipose Tissue	20
Adrenals	1800
Bone	50
Brain	500
Lung	180
Intestin	700
Kidneys	3600
Liver	750
Spleen	700
Thyroid	2500

Ref: Clin. Phys. Physiol. Meas 1989;10:187–217.

cus of this review is on postoperative reactive bleeding.

Bleeding is a potentially life-threatening complication after thyroid surgery. Given the increasing drive towards a one-day hospitalization (with discharge the same day as the surgery), identify-ing patterns, timing and consequences of post-thyroidectomy bleeding are essential. Bleeding prevalence is 0.36-4.3%.[1–17] This variance is selection-related. Series, including mono-centric outpatient and short-term thyroid interventions performed by a single surgeon, have less incidence of postoperative bleeding (0-0.19%); multi-centric studies with surgeries performed by different surgeons have a higher incidence of postoperative bleeding (3.6-4.2%).[1–17]

Many risk factors for post-thyroidectomy hemorrhage have been identified. [1–7] Early control of modifiable risk factors could improve patient outcomes. Contrary to the rate of recurrent lar-yngeal nerve paresis and hypoparathyroidism, neither the use of new surgical/technical innova-tions (energy-based devices, EBD), less invasive resections (lobectomy) or a strict standardiza-tion, have reduced incidence of bleeding. Even the introduction of topical homeostatic agents seems not to reduce the occurrence of bleeding significantly.[5] The comparison between ener-gy-based instruments and conventional ligation techniques shows no difference in the rate of re-bleeding, but energy-based devices have proved effective in reducing bleeding during the surgi-cal procedure.[1–5] The knowledge of the commonly recognized risk factors does not seem to allow a risk assessment or preventive pre- and intraoperative measures to decrease the risk of postoperative bleeding in each particular case (Fig. 1).[7] The economic pressure on the am-bulatory operation formula is reaching a limit of surgical accountability. The morbidity of rele-vant haemorrhages or hypoxic brain damage, even in a single case, can nullify the system's sav-ings of hundreds of successful

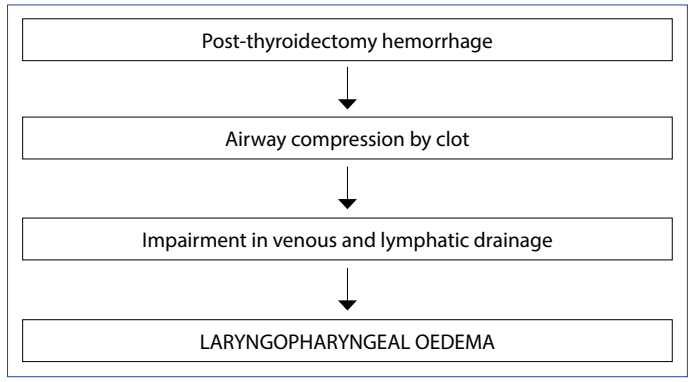

Figure 1. Postoperative hemorrhage consequence.

outpatient procedures.[15] If postoperative bleeding risk cannot be reduced per se, clinically relevant aspects should be emphasized: (a) preoperative identifica-tion of relevant influencing parameters, (b) optimization of postoperative monitoring and (c) management of bleeding (Tables 2, 3).

Appraisal

Data on Bleeding Incidence

Good-quality epidemiological studies on postoperative bleeding are lacking. Possible factors influencing different rates in postoperative bleeding have been discussed.[1–15] A possible explanation is that surgeons may underestimate the rates of postoperative bleeding since the complication (bleeding) is treated by a surgeon different from the surgeon who operated the patient in the first instance. Multi-center and registry studies on the rate of postoperative bleed-ing reveal a significant spectrum of prevalence with major differences in the surgeon and hospi-tal volumes (Tables 2, 3). The presentation of postoperative bleeding in thyroid

Table 2. Preventing haematoma development

- Identification of risk population
- Thyroid pathology
- Meticolous technique
- Type of procedure
- Surgeon experience
- Intraoperative maneuvers (Valsalva, etc..)
- New haemostatic instruments

Table 3. Haemostasis in Thyroid Surgery

- Diathermy
- Clamp-and-tie technique
- Vessel ligating clips
- Ultrasonic coagulating-dissection
- Electrothermal bipolar vessel sealing systems
- Topical haemostatic agents

surgery is done mostly without details with the inclusion of postoperative bleeding into the group of additional complication rates. Furthermore, only bleeding that has led to a re-intervention is taken into ac-count.[1–15] In most cases, information regarding risk factors, such as primary or re-do-surgery, concomitant parathyroid gland interventions, as well as specifics regarding surgical technique, approach, duration, surgeon and hospital volume, are missing, as well as a differenti-ation between postoperative seroma and hematoma.[1–15] The role of anticoagulation drugs, such as warfarin, low-dose aspirin, platelet inhibitor drugs, as well as selective serotonin recep-tor inhibitors (SSRIs) and bisphosphonates in the context of bleeding is not clear.

Location

Limited data exist on the site and origin of bleeding. Bleeding complications occur at a variety of sites. The most common sources of bleeding are both inferior and superior thyroid vessels, both vein and arteries.[1–15] Thyroid patients may also experience hemorrhage from cervical mus-cles and/or incision sites.[1–17] (Tables 3, 4) The post-thyroidectomy hemorrhage has some different clinical patterns if the bleeding occurs from a superficial site rather than a deeper site, showing that life-threatening airway obstruction occurs after hematoma formation in a deeper region of the neck.[11] A thorough understanding of the clinical patterns of post-thyroidectomy hemorrhage, both superficial bleeding and deep hematoma, may provide valuable surgical tips to manage this potentially lethal complication.[11] The authors performed a retrospective review of 10 patients (0.96%) with post-thyroidectomy hemorrhage that required surgical evacuation.[11] The clinical patterns, such as the time interval from surgery to hemorrhage and the signs and symptoms, according to the bleeding focus, were evaluated. The mean time interval from surgery to symptom onset was 7 hr 52 min. Six cases showed bleeding deep to the strap mus-cles, while the other four cases showed bleeding superficial to the muscles. Ecchymosis was prominent and dark in color in three of the four cases (75%) of superficial bleeding; however, it was identified in only two of the six cases (33%) of deep bleeding. Respiratory distress oc-curred in two cases of hematoma deep to the strap muscles, but also in none of the cases with superficial bleeding.[11]

Time Trends

Postoperative hemorrhage is a potentially severe complication with high mortality. The defini-tion of postoperative timing and first-line treatment is essential (Tables 4, 5). The

Table 4. Incidence of bleeding and number of revisions after thyroid surgery

Publication	Year	Total population (n)	Bleeding-rate (%)	>1 revision for bleeding (n)
Burkey et al.[3]	2001	13.817	0.3	1
Bergenfelz et al.[2]	2008	3.660	2.1	1
Lee et al.[11]	2009	1.040	0.9	0
Seybt et al.[20]	2010	4.18	0.2	0
Promberger et al.[14]	2012	30.142	1.7	26 (5%)
Lang et al.[10]	2012	3.086	0.7	1
Mazeh et al.[17]	2012	608	0.1	0

Table 5. Location of hematoma (Adapted from Lee HS, Lee BJ, Kim SW, Cha YW, Choi YS, Park YH, Lee KD. Patterns of Post-thyroidectomy Hemorrhage

Case	Site of the bleeding focus	Hematoma superficial to the strap muscle	Hematoma deep muscle to the strap
1	Sternocleidomaistoid muscle	Yes	No
2	Strap muscle	Yes	No
3	Sternocleidomaistoid muscle	Yes	No
4	Unknown	Yes	No
5	Cut surface of the thyroid remnant	Yes	Yes
6	Branch of the superior thyroid artery	Yes	Yes
7	Branch of the superior thyroid artery	No	Yes
8	Cricothyroid artery	No	Yes
9	Branch of the inferior thyroid artery	No	Yes
10	Branch of the superior thyroid artery	Yes	Yes

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description of the time course of the bleeding predominantly covers the time between the end of the initial thyroid operation and the time of the revision, more rarely the time until the first symptomatology. These times are only conditionally quantifiable due to structural quality, as well as standards of operation and postoperative monitoring. Approximately 85% of the re-bleeding occurs within 24 hours of the initial procedure, the majority in the first 8h, later bleeding is described up to 20 days postoperatively (Tables 4, 5).

Clinical Signs

There are hardly any systematic investigations on clinical signs of bleeding because these are influenced by the time of the acquisition, the amount of bleeding, patient-related factors, and they are often not present in all cases of postoperative bleeding.[1–15] Discrete signs, such as cervical pressure and tightness, coughing, difficulty in swallowing, change in voice, heat and/or feeling cold and restlessness, may be premature signs of externally visible swelling of the neck preceded by a blood-soaked dressing or rapid filling or occlusion of wound drainage (Tables 5, 6). The cervical swelling is not necessarily a sign of relevant bleeding, but may also occur on hemorrhage in the superficial subplatysmal layer. Conversely, a relevant hemorrhage in a deeper region of the neck may be present even without impressive neck swelling, especially with the midline completely closed. Cervical pressure and tightness, difficulty swallowing and subjective shortness of breath are possible bleeding signs. Shortness of breath, stridor, tachycardia and hypotension are considered to be signs of relevant bleeding, which offers no diagnostic margin and compels immediate reintervention. Laboratory tests to assess the level of hemoglobin and the parameters of coagulation determinations or cervical ultrasound examinations of the neck are not reliable diagnostic measures for the detection of bleeding and must be subordinated or omit-ted due to the acute nature of this complication.

Predictors of Bleeding

Prospective studies investigating the incidence, risk factors, and outcomes of surgical site hem-orrhage after thyroid surgery are limited. Specific risk factors for bleeding with a sure predictive value are unknown, but general risk factors are consistent across studies. These may be patient-related, intervention-related and/or related with the surgeon (Tables 6, 7). The clear separation of these risk factors is impossible due to non-excludable interdependencies. Patient-related risk factors are age and male sex. Surgery-related risk factors include bilateral, almost total, and total thyroidectomy versus subtotal resections, surgery for thyroid malignancies, duration of surgery, and elevated systolic blood pressure immediately after the surgical procedure. While the inci-dence of postoperative hemorrhage in thyroid surgery is relatively low, it may be associated with an increased risk of death. Individual surgeon performance as a relevant risk factor is as-sessed differently in studies. For Promberger et al.,[14] the surgeon has a significant influence on the incidence of postoperative bleeding regardless of his level of training. The quality of the ligatures or clips in the final hemostasis is relevant. Bleeding from initially occluded blood ves-sels, which have spontaneously dissolved or are reopened by mechanical stress during extuba-tion, postoperative vomiting and hypertension, makes it clear that the

Table 7. Clinical signs of postoperative cervical rebleeding after thyroid surgery

Symptom	Publication
Cervical pressure sensation	Burkey et al.,[3] Lee et al.[11]
Pain cervical region	Burkey et al.,[3] Lee et al.[11]
Cervical swelling	Lee et al.,[11] Promberger et al.[14]
Bleeding from the wound	Lee et al.,[11] Promberger et al.[14]
Pain	Lee et al.[11]
Difficulties swallowing	Burkey et al.,[3] Promberger et al.[14]
Shortness of breath	Lee et al.,[11] Promberger et al.[14]
Bleeding in drainage	Burkey et al.,[3] Promberger et al.[14]

Table 6. Timing of postoperative bleeding. Review of the literature

Author	Year	Patients	Hematomas (%)	Hematomas <8h	Hematomas >8h
Shaha	1994	600	8 (1.1)	6	2
Lo Gerfo	1998	203	2 (0.9)	2	0
Samson	1997	1.178	1 (0.08)	1	0
Lacoste	1993	3.008	11 (0.36)	9	2
Schwartz	1998	213	4 (1.8)	3	1
Hurtado-Lopez	2002	1.131	11 (0.97)	11	0
Burkey	2001	1.022	10 (0.90)	10	0
Abbas	2001	918 thyroidectomy	6/918 (0.7)	5	5
		350 parathyroidectomy	4/350 (1.1)		

cooperation with the anes-thesiologist greatly influences the result. The Valsalva maneuver before wound closure and ad-equate mean blood pressure help to detect both venous and arterial bleeding. To our knowledge, no study shows a significant influence of anticoagulation drugs on the incidence of re-bleeding, whereas a positive bleeding history in previous surgeries proved to be an important risk factor.[1–18] The impact of the underlying thyroid disease on the rate of bleeding is assessed differ-ently. Graves' disease, thyroiditis, and a thyroid malignancy are repeatedly referred to as risk factors for re-bleeding, whereas other authors deny a significant influence of these pathologies on postoperative bleeding frequency (Tables 6, 7). Thyroid surgery in local or general anesthesia wound drainage and recurrent surgery are not clearly identified as risk factors except some pub-lications because their statistical impact cannot be evaluated separately from other risk factors.[1–11]

Clinical Impact and Additional Complications

To our knowledge, no study systematically records the complications resulting from bleeding events. The inpatient length of stay is extended.[1–18] Most typical complications are listed without reference to possible dependencies so that the complications due to bleeding can only be vaguely guessed. These include uni- and bilateral recurrent paresis, tracheostomy, hypoparathy-roidism, wound healing disorder, hypoxic brain damage and death (Tables 7, 8).

Importance of Management

Postoperative thyroidectomy or parathyroidectomy hemorrhage may have catastrophic conse-quences, and the surgeon must take great care in ligating any visible vessels and coagulating all bleeding points. The primary sign of postoperative hemorrhage is likely to be airway obstruc-tion (Fig. 1). This occurs because the pretracheal fascia of the neck as a limited stretching ability and, if filled with blood, will cause tracheal compression and eventually asphyxiation. Any evidence of respiratory distress or airway compromise in these patients requires an emer-gency protocol for airway rescue (Table 9). This involves removing both the skin clips and deep layer sutures and evacuating the hematoma beneath. All these procedures are done at the pa-tient's bed as there is no time to get the patient to the operating room. An urgent senior surgical opinion should be sought, and the anesthesiologist must be informed to organize everything needed. The time factor is crucial in the treatment of bleeding after thyroid surgery. Management and outcome depend primarily on timely diagnosis and are closely related to structures and standards that begin in the operating room with the anesthesia delivery phase and extubation, continue in the recovery room and extend during all the inpatient period. Timely bleeding man-agement requires trained nursing staff, especially in the early postoperative period. The clinical conditions, the surgical wound and the vital parameters of the patient must be verified continu-ously at least every 4-8 hours postoperatively to ensure prompt surgical intervention when needed (Table 10). The diagnostic objectification of bleeding in case of doubt is set aside to al-low a rapid surgical revision intervention. As airway safety has priority, it must be decided clin-ically whether an immediate wound opening is required before transfer to the operating room to allow for immediate intubation. Ideally, the decision on wound revision should be made quickly so that a reintubation and revision in the operating room can be made under sterile conditions. The use of neuromonitoring in this particular situation must be evaluated case by case. It is of great value due to the extremely difficult direct visualization of the recurrent laryngeal nerve in the area of the hematoma; it also secures the condition of extubation thanks to the evidence of intact vocal cord function despite the concomitant edema. The protective value of prophylactic local hemostatic agents has not been established but is recommended for minor bleeding too close to the nerve to be safely treated with ligatures or clips. The assessment of wound condi-tions after bleeding is particularly challenging due to external hematoma and edema formation. Diagnostic or therapeutic-interventional radiology plays no role in the treatment of postoperative bleeding after thyroid surgery. Only a small group of patients with superficial hematoma and minimal swelling, lack of symptoms and no progression of their haematoma should be consid-ered for conservative management (Table 11).

Table 8. Risk factors for bleeding

Patient related	Surgical technique
• Haemophilia	• Mode of access
• Von Willebrand's disease	• Strap muscle division
• Chronic renal failure	• Subplatysmal flaps
• Cirrhosis/alcohol use	• Limited dissection (MIVAT)
• Anticoagulant medications	• Bilateral exploration
• Smoking	• Residual thyroid tissue
Thyroid pathology	• Surgeon experience
• Graves' disease	• Use of drains
• Toxic adenoma	Postoperative events
• Toxic multinodular gland	• Cough
• Intrathoracic goiters	• Emesis
• Re-operative goiters	• Hypertension
• Malignancies	

Table 9. Risk factors of postoperative bleeding after thyroid surgery

Risk factor	Specific	Publication	
		Positive	Negative
Age			
	>45 years	Weiss et al.[17]	Leyre et al.[12]
	>50 years	Godballe et al.[9]	
	58 years	Promberger et al.[14]	
	>60 years	Bergenfelz et al.,[2] Campbell et al.[4]	Morton et al.[13]
Male gender		Leyre et al.,[12] Weiss et al.,[17] Bergenfelz et al.,[2] Campbell,[4] Promberger et al.,[14] Lang et al,[10] Godballe et al.[9]	
Diagnosis	Graves Disease	Campbell[4]	Leyre et al.,[12] Promberger et al.,[14] Lang et al.[10]
	Thyroiditis	Weiss et al.[17]	Promberger et al.,[14] Lang et al.[10]
	Malignancy	Campbell,[4] Promberger et al.,[14] Godballe et al.[9]	Lang et al.[10]
Intervention	Recurrence-operation	Lang et al.,[10] Promberger et al.[14]	Leyre et al.,[12] Burkey et al.,[3] Morton[13]
	Bilateral resection	Campbell,[2] Promberger et al.[12]	
Resection	HT	Promberger et al.,[12] Godballe et al.[9]	Leyre et al.[12]
	sTT	Weiss et al.[17]	
Resection weight		Campbell,[4] Lang et al.[10]	Morton,[13] Lang et al.[10]
	Operation time	Burkey et al.,[3] Godballe et al.[9]	Morton[13]
Laboratory coagulation pathology		Weiss et al.[17]	Burkey et al.[3]
Coagulation-relevant medication		Campbell,[4] Rosenbaum et al.,[15]	Leyre et al.,[12] Burkey et al.,[3] Weiss et al.[17]
Preoperative dyspnoea		Leyre et al.[12]	
Body-Mass-Index		Burkey et al.[3]	Morton[13]
Cough, vomiting postoperatively		Rosenbaum et al.,[15]	Burkey et al.[3]
Hypertension postoperatively		Campbell,[4] Morton,[13] Burkey et al.[3]	
Surgeon-volume		Promberger et al.,[14] Godballe et al.[9]	Bergamaschi et al.[1]
Hospital volume		Weiss et al.[17]	Godballe et al.[9]
Renal insufficiency		Weiss et al.[17]	
Wound drainage		Campbell,[4] Godballe et al.[9]	Morton[13]

HT hemithyroidectomy; sTT subtotal thyroidectomy.

Conclusion

Ambulatory thyroid surgery is well accepted and is the standard of care at many American ter-tiary centers.[7] Rather than being hospitalized after surgery, patients are discharged the day as surgery or within 23 hours.[11] Such early discharge does not adversely affect patient out-comes and has the added benefits of better psychological adjustment for the patient, economic savings and more efficient utilization of health care resources.[8, 15] The minimal care needed post-discharge also means that the caregiver is not unduly burdened. Unplanned transition to inpatient admission and readmission rates is low. Wound complications are infrequent, and no issues with drain care have been reported. Because the period of postoperative observation is short and monitoring is not so intensive, ambulatory surgery is only suitable for low-risk pro-cedures, such as lobectomy, parathyroid resections surgery and patients without seri-

Table 10. Complications in postoperative bleeding after thyroid surgery

Complication	Publication	Comparison not bleeding, (%)	Bleeding (%)
Recurrent laryngeal nerve palsy/NAR	Burkey et al.[3]	0	7.1
	Burkey et al.[3]	4.7	7.1
	Promberger et al.[14]	4.4	5.1
Tracheotomy	Burkey et al.[3]	0	4.8
	Promberger et al.[14]	n/l	1.7
Mortality	Weiss et al.[17]	0.32	1.34
	Promberger et al.[14]	0.01	0.6

BMI Body-Mass-Index; n/l no information; NAR: nerves at risk.

Table 11. Additional Complications from intra- and postoperative bleeding

Intraoperative bleeding

- Prolongs operation & intubation
- Risk to adjacent organs (parathyroids & laryngeal nerves)
- MIVAT: cause for conversion to the open technique

Postoperative bleeding

- Death
- Re-operation
- Prolongs intubation for laryngeal edema
- Risk to adjacent organs
- Tracheostomy
- Prolongs hospitalization
- Wound infections
- Transfusion
- Other (i.e. myocardial infarction, etc..)

ous comor-bidities, where the likelihood of major perioperative events, such as postoperative bleeding, is low. We are not against the ambulatory surgery, but undoubtedly this must be addressed to a selected population, with careful observation of the patient at the time of discharge and the pa-tient, as well as his family members, must be properly trained. Optimal management of pain, nausea, and vomiting is essential to ensure a quick recovery and return to normal function. In general, postoperative bleeding rate, considered as a quality parameter, remains unchanged in thyroid surgery with an incidence of 0-4%.[1–12] Studies investigating the influence of the surgeon's volume and surgeon's qualification describe a positive correlation between higher experience and qualification and lower complication rate. Surgeon's volume proved to have a considerable effect on the overall complication rate of thyroid surgery compared to hospital vol-ume. However, this effect cannot be highlighted as far as postoperative bleeding is concerned. It can be assumed that with the bleeding event, the hospital volume as a structural parameter be-comes more decisive. The quality of postoperative bleeding management is fundamental in avoiding even more severe complications. Retrospective multicentre studies showed that risk factors, such as age, gender and preoperative diagnosis, are immutable factors, and there are no pre- or intraoperatively proven prophylactic measures to avoid the occurrence of postoperative bleeding.[1–12] Despite the increase in radicality, bilaterality and coagulation-related drugs, there has been no increase in bleeding incidence, which is considered to be a surgical quality improvement. Surgical standardization with technical refinement, bipolar cauterization, loupes and even closer collaboration with the anesthesiologist should have contributed to this im-provement.

To summarize, it is the duty of the whole care team and not only of the surgeon to make sure that the management of postoperative bleeding occurs as quickly as possible and according to the highest standards of care. This requires close clinical monitoring during the first 4-6 h post-operatively and then appropriate control for at least 24 h for all bilateral thyroid interventions. This allows early detection of any symptoms or signs of bleeding, thus minimizing the risk of complications. The importance of these measures lies in the severity of complications of bleed-ing. In studies on the correlation of bleeding with specific complications, the permanent recur-rent paralysis rate tends to increase significantly; the tracheostomy rates are significantly higher, and the mortality more than twice as high as compared to a regular course after thyroid surgeryv.[1–12] Ensuring surgical quality and a high level of postoperative monitoring is a prerequisite for responsible thyroid surgery.[1–12]

Disclosures

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