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CONTEMPORARY STRATEGIES FOR HEMOSTASIS AND PREVENTION OF POSTOPERATIVE COMPLICATIONS IN THYROID SURGERY

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Abstract

Thyroid surgery is one of the most common procedures in endocrine surgery, and its safety depends largely on preventing postoperative haemorrhage, recurrent laryngeal nerve injury and hypoparathyroidism. To analyse international and regional literature on measures to prevent complications and the effectiveness of haemostatic methods in thyroid surgery, including ligation, bipolar coagulation, energy-based devices, topical haemostatic agents and wound drainage. Postoperative bleeding is reported in approximately 1–2% of cases. Risk factors include older age, reoperation, retrosternal goitre, extent of thyroidectomy and surgeon experience. Meta-analyses have found no significant differences in key clinical outcomes between energy-based devices. Evidence on topical haemostatic agents is inconsistent and relates mainly to drain output and length of hospital stay. Routine drainage does not reduce bleeding risk and may increase the risk of infection. A single-centre regional study reported that the overall complication rate decreased from 29.5% to 10.2% when Hemoben was combined with low-level laser therapy; however, the findings were based on a historical control group. Reliable haemostasis, surgical technique and surgeon experience remain crucial. Multicentre randomised studies are needed to establish the effectiveness of newer local methods.

Keywords: Thyroid gland, thyroidectomy, haemostasis, postoperative haemorrhage, energy-based devices, topical haemostatic agents, drainage, low-level laser therapy, complication prevention.

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Introduction

Surgical treatment of thyroid disorders has changed considerably over recent decades, and complication rates have declined; nevertheless, even the most advanced techniques and devices cannot eliminate complications entirely [1, 2]. Uzbekistan is among the regions historically affected by severe iodine deficiency: surveys in 1998 reported endemic goitre prevalence of up to 80%, and a law on salt iodisation was adopted in 2007 [3]. Given the substantial number of patients in the region who require surgery, reducing surgical complications is of practical importance. Postoperative haemorrhage is one of the most dangerous complications. According to national registry data, bleeding occurs in approximately 1–2% of patients after thyroidectomy, and about one-quarter of these cases require urgent evacuation of a blood clot at the bedside [4]. In a single-centre series of 2,678 patients, the rate was 1.5%, and 59% of bleeding events occurred within the first four postoperative hours [5]. Reported rates in the literature range from 0 to 4.2% [5]. In addition to bleeding, transient recurrent laryngeal nerve injury is reported in 1–10% of cases and permanent injury in approximately 0.5–2% [6]; one single-centre cohort reported rates of 10.6% and 1.1%, respectively [7]. Despite this, there is no consensus on the optimal haemostatic method: some authors favour biological (topical) agents, while others prefer advanced energy-based devices [1]. A meta-analysis found that haemostatic agents provide little demonstrable clinical benefit [8]. Diffuse capillary bleeding in toxic diffuse goitre is a particular challenge, and its causes and management options have not been adequately addressed in the literature [2]. The aim of this review is to summarise international and regional evidence on complication prevention and the effectiveness of haemostatic methods in thyroid surgery, and to assess the clinical experience from Andijan in the context of international evidence.

Materials and Methods

This study was conducted as a narrative review. Sources were gathered from three areas: (1) meta-analyses, systematic reviews, randomised and cohort studies, and clinical recommendations published in international journals indexed in

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PubMed/PMC or available on publishers' websites; (2) medical journals from Uzbekistan (Bukhara, Samarkand and Andijan) and Russian-language scientific publications; and (3) clinical manuscripts from Andijan State Medical Institute on local haemostasis during thyroid surgery. Search terms included "postoperative bleeding and risk factors", "haemostatic agents", "energy-based devices (LigaSure, Harmonic)", "drainage", "recurrent laryngeal nerve injury and hypoparathyroidism", "low-level laser and wound healing", and "goitre and surgery in Uzbekistan". Inclusion criteria were relevance to thyroid surgery, haemostasis or complication prevention; availability of the full text or an official abstract; and publication between 2004 and 2026. A total of 51 sources were included: 35 international publications, 13 regional (Uzbekistan and Russian-language) publications, and the three aforementioned manuscripts. Because the manuscripts had no stated publication year, they were excluded from the year-by-year graph, which therefore represents 48 publications. For each source, the study design, sample size, methods compared and principal clinical outcomes (bleeding, haematoma, seroma, nerve injury, hypoparathyroidism, drain output and length of stay) were extracted.

Results and discussion

As shown in Figure 1, the 48 publications analysed cover the period 2004–2026; 12 (approximately 25%) were published in the last five years (2021–2026), indicating continuing interest in the topic. By study design (Figure 2), meta-analyses and systematic reviews (15) and cohort/retrospective studies (13) predominated, while five studies were randomised or prospective. Regional and Russian-language publications (12) mainly addressed practical aspects of the subject.

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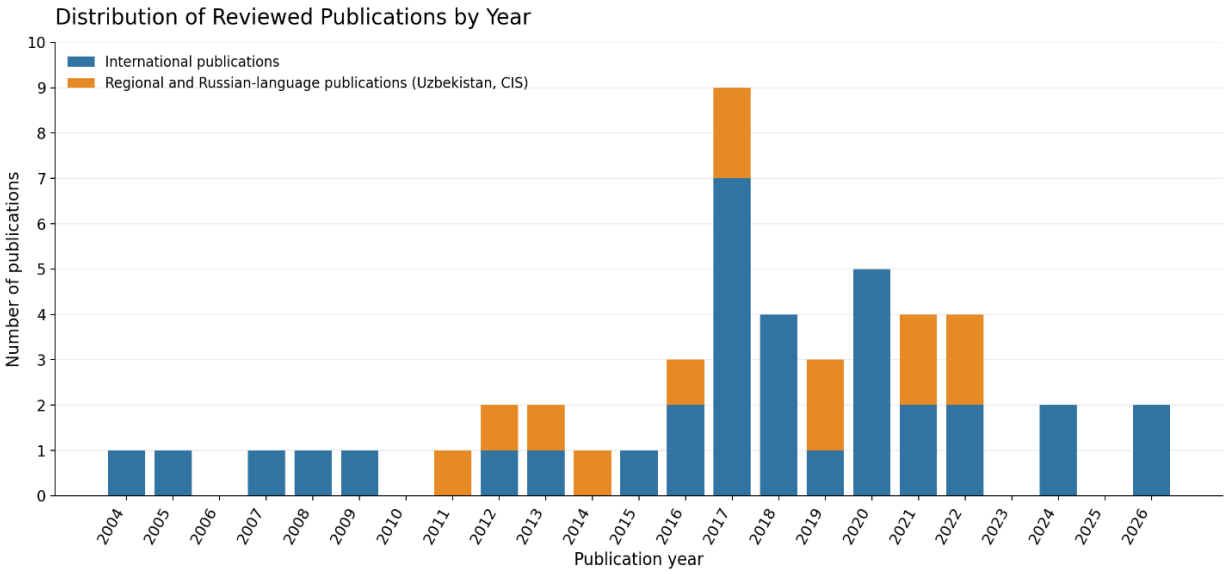


Figure 1. Distribution of the analysed publications by year (48 publications in total).

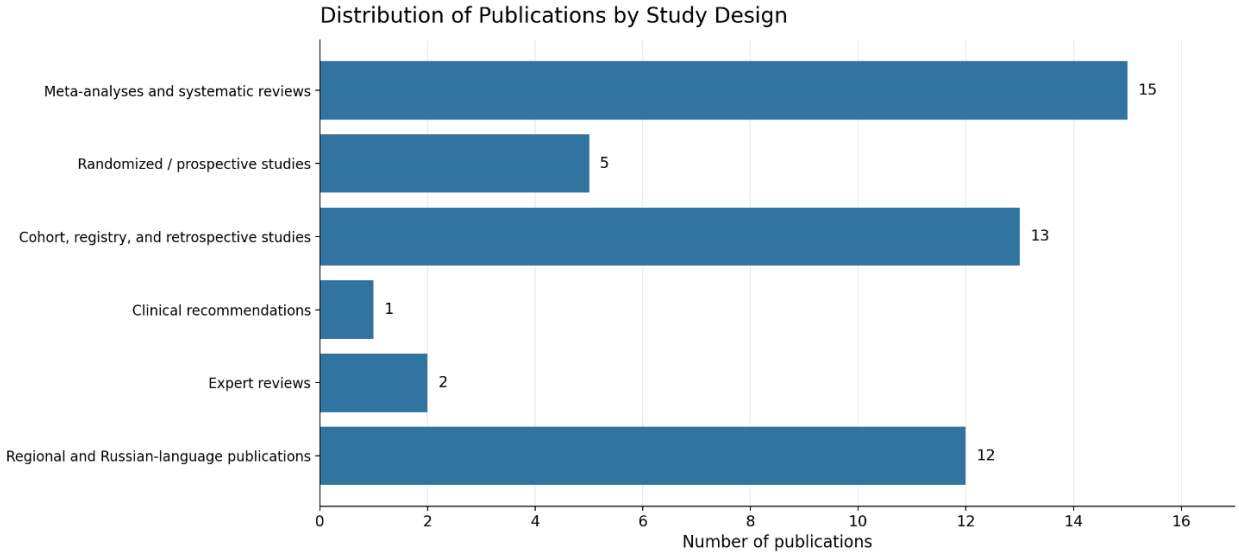


Figure 2. Distribution of the analysed publications by study design.

A study analysing data from the United Kingdom's endocrine and thyroid surgery registry for 2004–2018 found that older age, reoperation, retrosternal goitre and total thyroidectomy increased the risk of reoperation for bleeding, whereas a higher monthly surgical case volume was associated with a lower risk. Mortality after thyroidectomy was 0.1% (23 of 38,740 cases) [4]. In a cohort of 2,678

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patients, a body mass index above 30 was the only factor associated with an almost sixfold increase in bleeding risk [5]. A study published in a Chinese otorhinolaryngology journal reported bleeding in 40 of 2,568 patients; the extent of resection and the surgeon were identified as risk factors, and the thyroid bed and neck muscles were common bleeding sources [9]. A meta-analysis of risk factors has also been published [10]. An important practical question is when bleeding occurs. A systematic review of outpatient hemithyroidectomy reported bleeding rates of 1.1% among inpatients and 0.6% among outpatients; however, the authors noted that lower-risk patients were selected for outpatient care and that most included studies were of low quality [11]. Since a substantial proportion of bleeding events occur in the first few hours [5], early monitoring remains essential. Wojtczak and colleagues analysed 7,805 operations and considered bleeding accompanied by laryngeal oedema a directly life-threatening complication [12]. Other large studies, including one involving 14,934 patients in Italy and an analysis of a US national inpatient database, have also assessed complications and risk factors for neck haematoma [13, 14]. Unplanned reoperation and readmission have been examined in a separate meta-analysis [15].

Effectiveness of haemostatic methods. Conventional methods and energy-based devices. For many years, clamps and ligatures were the main method for dividing thyroid vascular pedicles. Bipolar electrocoagulation was initially used only for small vessels, but devices using radiofrequency or ultrasonic energy subsequently became widespread [2]. A meta-analysis of randomised trials found that the Harmonic scalpel was superior to LigaSure only in terms of operative duration [16]. In a randomised study of 182 patients, no significant differences were found between LigaSure and Harmonic Focus in nerve injury, bleeding, drainage, operative time or serum calcium; however, swallowing pain was more frequent and early parathyroid hormone levels were lower in the Focus group [17]. A retrospective analysis of 1,165 patients compared outcomes and complications with Harmonic Focus, LigaSure Small Jaw and Thunderbeat [18]. Meta-analyses comparing LigaSure with ligation [19], radiofrequency bipolar devices with ultrasonic scalpels [20], and Harmonic with conventional haemostasis [21] are

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also available. The effect of energy-based devices on recurrent laryngeal nerve injury has been assessed in a separate systematic review [22], and another review addressed their role in haemostasis [23]. Russian-language publications have also reported outcomes with LigaSure [24] and electrowelding technology [25].

A meta-analysis combining 10 studies (941 patients, including 519 who received an agent) found that gels or oxidised cellulose patches did not change the risk of haematoma compared with conventional haemostasis, nor did they alter seroma risk, although length of hospital stay was reduced. The authors concluded that the overall benefit was minimal [8]. In a retrospective study (279 patients, 414 lobectomies), the authors suggested that the technique used to coagulate major vessels might be less important than the use of haemostatic agents in diffuse bleeding, while noting that their effectiveness remains controversial. Because oxidised cellulose is absorbed slowly, it may mimic an abscess or tumour [26]. Both a collagen–fibrinogen–thrombin patch and cellulose gauze reduced serosanguineous discharge during the first 24 hours, with the patch being more effective [27]. A prospective randomised study of the FloSeal matrix has also been conducted [28]. A network meta-analysis compared topical haemostatic agents [29]. A 2024 meta-analysis of randomised trials on fibrin glue found reductions in drain output, hospital stay and operative duration, but no change in seroma or hypoparathyroidism rates [30]. Russian-language reviews have also discussed trends in topical haemostatic agents and flowable active haemostatic matrices [31–33], while prevention of intraoperative bleeding in large and giant goitres has been considered separately [34].

Wound drainage. Drains are commonly used to detect bleeding early, but evidence does not confirm their benefit. A meta-analysis of 11 randomised studies found no difference between groups in the incidence of neck haematoma/seroma (OR 1.03); hospital stay was, on average, 1.53 days longer in the drainage group [35]. An analysis of 14 studies (1,927 patients) found a higher risk of infection in patients with drains (OR 2.94), with no differences in haematoma, bleeding, hypoparathyroidism, nerve palsy or seroma [36]. A meta-analysis of 16 studies also associated drainage with more infections and longer hospitalisation [37], whereas another analysis found no statistically significant benefit or harm [38].

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Thus, a drain is a monitoring tool rather than a method of preventing bleeding, and routine use should be justified. In the Andijan reports, drain output and duration of drainage were considered indirect indicators of the adequacy of haemostasis [39].

Low-level laser therapy. A review evaluating laser effects on wound healing noted that positive results from small case series involving human skin wounds had not been reproduced in larger studies; therefore, evidence was insufficient to support widespread use [40]. A randomised, double-blind, sham-device-controlled trial of 830-nm photobiomodulation therapy to prevent scars after thyroid surgery [41] and a prospective study (12 patients) combining fractional CO_2 laser with steroids [42] have been published. These studies primarily addressed scar appearance and are not directly related to intraoperative haemostasis.

Risk factors for recurrent laryngeal nerve injury include age, female sex, extended thyroidectomy, lymph node dissection, reoperation, retrosternal goitre and absence of nerve monitoring [6]. Rates of transient nerve palsy and hypocalcaemia were higher after reoperations than after primary surgery [43]. In total thyroidectomy, BMI was not associated with nerve palsy, whereas a lower BMI was associated with transient hypoparathyroidism [44]. These findings indicate that reducing complications depends not only on the haemostatic method but also on patient selection, the extent of surgery and surgeon experience. Regional reports have also noted that bleeding from residual tissue in diffuse toxic goitre may require repeated coagulation and potentially contribute to other complications [45]; the prevention of complications remains a matter of debate [46]. Russian-language analyses have likewise examined the spectrum of complications and bleeding requiring repeat surgery [47–50].

Discussion of the findings

International evidence indicates that bleeding after thyroid surgery is uncommon but remains a potentially fatal complication; its incidence in the studies reviewed was generally around 1–2% [4, 5]. Risk factors relate to both the patient (age, body mass, reoperation and retrosternal goitre) and the procedure (extent of surgery and surgeon experience) [4, 5, 9]. Therefore, the effectiveness of any

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haemostatic method should be assessed in light of these influencing factors. The choice between energy-based devices appears to be driven mainly by operative time and convenience, as no differences have been demonstrated in major clinical outcomes [16, 17]. Evidence for topical haemostatic agents is inconsistent: some studies report reductions in drain output, length of stay and operative duration [27, 30], but their effect on haematoma and seroma risk remains uncertain [8, 30]. Drainage does not prevent bleeding and may increase infection risk [35–37]. In this context, the Andijan findings on the combination of Hemoben and laser irradiation (complications reduced from 29.5% to 10.2%; haemostasis time from 12.1 to 6.5 minutes) are of practical interest, but should be interpreted cautiously. First, the study was non-randomised and conducted at a single centre; the groups were treated in different periods (2020–2021 versus 2022–2023), so surgeon experience, perioperative care and other time-dependent factors may have influenced the results. Second, the absolute number of bleeding events in the control group was small (four cases), so the confidence interval is likely to be wide. Third, Hemoben and laser treatment were used together, making it impossible to isolate the contribution of each intervention. Fourth, independent evidence for the effect of low-level laser therapy on wound healing is inconsistent [40]. The reduction in nerve-related complications such as vocal cord palsy may be attributable to surgical technique and nerve identification rather than haemostasis [6]. The authors reported preliminary positive findings in experimental animals (24 rats), but the clinical conclusions require confirmation in a multicentre randomised trial. Assess patient risk factors before surgery; whenever possible, ensure that the procedure is performed by an experienced surgeon; provide early postoperative monitoring because bleeding most often occurs in the first few hours [5]; use drains selectively rather than routinely [35, 36]; and consider topical haemostatic agents as an adjunct, particularly in diffuse bleeding [26]. Recommendations from the American Association of Endocrine Surgeons on definitive surgical management of thyroid disease in adults are also available as a practical guide [51].

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Conclusion

Postoperative bleeding after thyroid surgery is relatively uncommon (approximately 1–2%) but may be life-threatening. Risk factors are patient- and procedure-related; the most important preventive measures are reliable haemostasis, surgeon experience and monitoring during the first postoperative hours. Energy-based devices do not differ significantly from one another or from conventional methods in major clinical outcomes; in the comparisons reviewed, their main advantage was a reduction in operative time. Topical haemostatic agents may improve drain output and length of stay, but an effect on haematoma and seroma risk has not been established. Routine drainage does not reduce the risk of bleeding and may increase infection risk and length of hospital stay; selective use is therefore preferable. In the reviewed clinical experience, the combination of Hemoben and low-level laser therapy was associated with lower complication rates, shorter haemostasis time and improved drainage indicators. However, because the study used a historical control and a single-centre design, these findings should be considered preliminary and require confirmation in a multicentre randomised trial.

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