Interdisciplinary Research in Medical Sciences Specialty
ISSN: 3062-4401
2025, Volume 5, Issue 1, Page No: 23-28

Available online at: www.galaxypub.co/page/journals

Galaxy Publication

Post-Surgical Complications of the Thyroid Gland: Insights from the Literature

Olesya Olegovna Kalion[1], Ekaterina Sergeevna Stepanova[1], Umar Magomedovich Gaziev[2], Valeriia Romanovna Prikhodko[3], Manuela Nikolaevna Iazhian[3], Raisa Ilyinichna Mikhailova[1], Anar Maarifovich Askerov[4], Abdul-Vakhab Abubakarovich Ayubov[5*]

[1] Department of Therapy, Faculty of Medicine, Stavropol State Medical University, Stavropol, Russia.
[2] Department of Therapy, Faculty of Pediatrics, Stavropol State Medical University, Stavropol, Russia.
[3] Department of Therapy, Faculty of Medicine, Kuban State Medical University, Krasnodar, Russia.
[4] Department of Therapy, Faculty of Medicine, Saratov State Medical University named after V.I. Razumovsky, Saratov, Russia.
[5] Department of Therapy, Faculty of Pediatrics, North Ossetian State Medical Academy, Vladikavkaz, Republic of North Ossetia-Alania, Russia.

***E-mail** ✉ katya-stepanova1996@yandex.ru

Received: 10 January 2025; **Revised:** 24 March 2025; **Accepted:** 04 April 2025

ABSTRACT

Thyroid surgery is commonly indicated for a variety of clinical reasons, with one of the primary purposes being the diagnostic evaluation of thyroid tumors using fine needle biopsy. This technique continues to represent the gold standard in the evaluation of thyroid nodules. In recent years, especially over the past decade and a half, Russia has experienced a significant increase in the incidence of thyroid carcinoma. This upward trend is largely associated with the advancement and widespread implementation of more accurate diagnostic techniques, which have improved the detection rate of even very small malignant lesions. Furthermore, the presence of tumors originating from Hurthle cells usually necessitates surgical intervention, often in the form of lobectomy at a minimum, given that pathohistological examination remains the most definitive approach for differentiating between benign and malignant lesions. Patients must receive comprehensive counseling on the possible complications associated with thyroid surgery before undergoing any surgical procedure. They should be fully informed about all the potential risks involved. This literature review focuses on both minor complications, such as seroma formation, and more serious adverse outcomes, including recurrent neural injury, hypoparathyroidism, hemorrhage, and seroma. In addition, the review examines current strategies for managing and preventing these postoperative complications.

Keywords: Thyroidectomy, Thyroid surgery, Hypocalcemia, Complications

How to Cite This Article: Olegovna Kalion O, Sergeevna Stepanova E, Magomedovich Gaziev U, Romanovna Prikhodko V, Nikolaevna Iazhian M, Ilyinichna Mikhailova R, et al. Post-Surgical Complications of the Thyroid Gland: Insights from the Literature. Interdiscip Res Med Sci Spec. 2025;5(1):23-8. https://doi.org/10.51847/lNIPS8K5pi

Introduction

Understanding of thyroid gland disorders extends far back in human history, with some of the earliest mentions traced to the second millennium BC, where ancient Chinese medical texts referred to struma. The presence of endemic goiter was also familiar to classical civilizations such as the Greeks and Romans, with well-known historical figures including Hippocrates, Pliny the Elder, and Marco Polo documenting the disease. In the 1500s, Paracelsus was the first to highlight the association between endemic goiter and cretinism, drawing attention to the public health impact of this condition [1].

Early anatomical observations of the thyroid gland were recorded by K. Galen in the early 15th century, although a more comprehensive description was later produced by A. Vesalius in 1543. A pivotal moment in thyroid physiology came in 1836 when Th. W. King proposed the concept that the gland possessed intracretory activity, a theory later validated in 1855 by Claude Bernard, who demonstrated that the gland releases secretions directly

into the bloodstream, influencing systemic functions. The clinical features of thyroid overactivity were independently detailed by Graves in 1835 and K. Bazedov in 1840.

By 1880, Borneville recognized the congenital absence of the thyroid gland as a cause of myxedema, a term used to describe the condition resulting from this deficiency. Initial attempts at managing myxedema included thyroid transplantation, pioneered by Pastor *et al.* [1], who reported transient improvement in affected patients.

The therapeutic application of thyroid extracts was first successfully demonstrated in humans by Murray in 1891, who treated myxedema with this method. Later, in 1896, E. Baumann provided evidence of the relationship between iodine intake and the functional regulation of the thyroid gland.

Significant biochemical advancements were achieved in 1915 when Kendall succeeded in isolating and purifying L-thyroxine, the primary hormone of the thyroid gland. The hormone's chemical structure was later identified and synthesized following the work of Harington and Berger between 1926 and 1927. Parallel research efforts by Hershman *et al.* [2] and Orloff and Parangi [3] established the existence of a second hormone produced by the thyroid gland, triiodothyronine, thereby enriching scientific knowledge of thyroid function.

The mid-19th century marked the emergence and evolution of thyroid surgery, closely tied to the pioneering work of Jacques Reverden and Theodor Kocher. Reverden is credited with laying the foundation of thyroid surgical practice and was the first to introduce the term "mixoedeme postoperatoire" about the postoperative condition observed following thyroid gland removal.

For many years, the distinct functions of the thyroid and parathyroid glands were poorly understood, leading to significant challenges in identifying the thyroid's precise role in maintaining physiological balance. This knowledge gap contributed to numerous complications after thyroid surgeries. A breakthrough came in 1880 when the Swedish scientist Ivar Sandström identified the presence of epithelial bodies — later known as the parathyroid glands — in both humans and animals. Subsequent experimental research by Glei in 1891 demonstrated the vital importance of these glands in sustaining life, particularly concerning calcium metabolism. It became evident that tetany observed after thyroid surgery was not due to thyroid removal itself, but rather the inadvertent excision of the parathyroid glands during the procedure [2].

A transformative figure in thyroid surgery was Theodor Kocher, a Swiss surgeon and professor at the University of Bern. Kocher's extensive contributions spanned the fields of asepsis, antiseptics, abdominal surgery, and trauma care. His globally recognized research addressed various thyroid-related conditions, including goiter, thyrotoxicosis, goiter-associated cretinism, and the therapeutic use of iodine. He also investigated preventive measures against thyrotoxicosis and provided new insights into Basedova disease. Kocher introduced the term "Cachexia thyreopriva" to describe severe thyroid hormone deficiency and established foundational surgical techniques for thyroid gland operations.

In 1906, George Crile, an American surgeon, introduced an innovative approach for managing metastatic cancer of the head and neck. His method involved en bloc removal of cervical tissues alongside the primary tumor, aiming for more comprehensive cancer control. This surgical principle, later refined and adapted by Baloch and LiVolsi [4], was subsequently applied to the treatment of metastatic lesions from tumors originating in the upper respiratory tract, salivary glands, and thyroid gland.

This literature review focuses on both minor complications, such as seroma formation, and more serious adverse outcomes, including recurrent neural injury, hypoparathyroidism, hemorrhage, and seroma. In addition, the review explores current strategies for the management and prevention of these postoperative complications.

Materials and Methods

A thorough investigation was performed by reviewing scientific articles, abstracts, and other relevant literature across various databases using search terms such as "thyroid surgery," "complications," "hypocalcemia," and "thyroidectomy." The primary databases consulted included PubMed, Hindawi, CyberLeninka, and Google Scholar, with full access to pertinent materials. Moreover, a manual search of relevant sources was also conducted to ensure comprehensive coverage.

Results and Discussion

Figure 1 illustrates how patients are categorized by gender concerning the type of pathology.

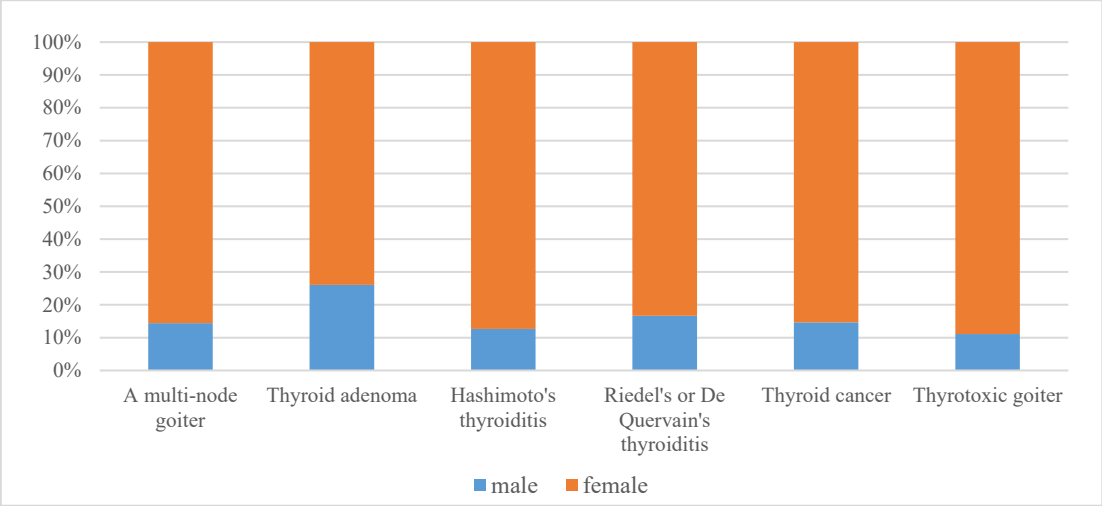

Figure 1. Distribution of patients by pathology and gender

Thyroid surgery complications can be categorized into mild and severe types. **Figure 2** displays the distribution of these complications based on the extent of the surgery performed. Among the less severe complications are seroma formation and more noticeable wound scarring. Seroma refers to the collection of clear fluid that accumulates after a surgical procedure or injury [5]. While smaller seromas may resolve without intervention, larger ones typically require aspiration and drainage under sterile conditions. Although there has been limited research on seroma formation following thyroidectomy, it is believed that newer technologies like ultrasonic coagulation knives may help reduce the occurrence of seromas by providing quicker and more effective tissue coagulation [6]. Additionally, ensuring proper drainage of the wound during the healing process is recommended.

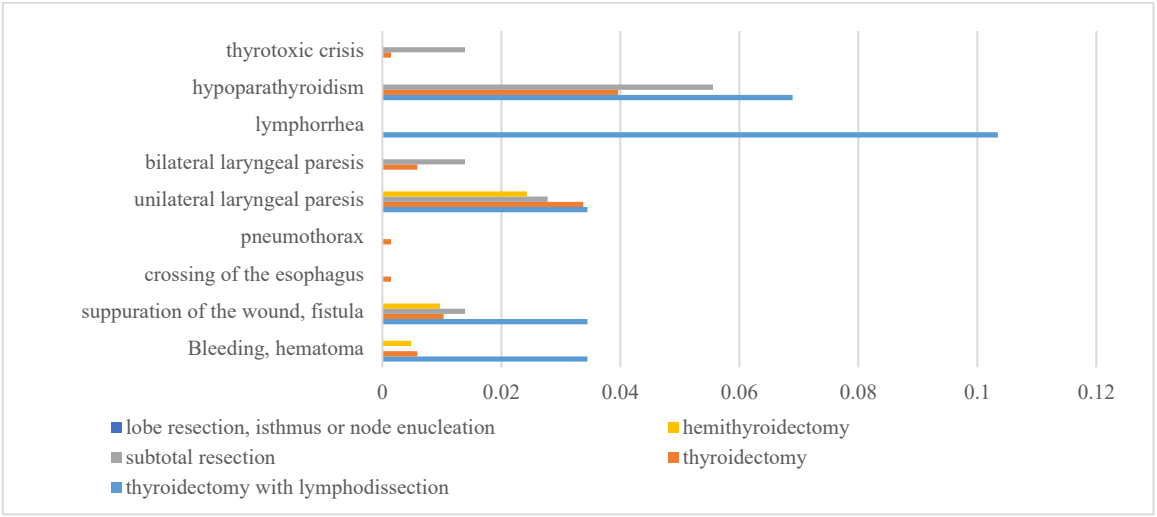

Figure 2. The prevalence of postoperative complications depends on the volume of surgery

For many women and younger individuals undergoing thyroid surgery, achieving satisfactory aesthetic outcomes is of utmost importance. This is particularly crucial during thyroidectomy, where an incision in the neck—a visible and prominent area—should be as minimally invasive and delicate as possible. Traditional thyroidectomy methods, however, are associated with a higher likelihood of scarring compared to less commonly used endoscopic techniques. Scarring not only affects appearance but may also lead to sensations such as a foreign body feeling or difficulty swallowing. Additionally, scar tissue may extend deeper into the muscles and reach the thyroid cartilage (Kim) [7].

Research investigating factors that contribute to hypertrophic scarring post-thyroidectomy has highlighted that factors like prominent sternocleidomastoid muscles and a narrow distance between the incision and the jugular notch increase the likelihood of developing hypertrophic scars [8, 9]. Despite its clinical significance, hypertrophic scarring is not widely discussed in the literature.

Postoperative dysphagia is often a consequence of surgical procedures on paratracheal tumors or hyperthyroidism, as nerve fibers and blood vessels supplying the muscles may be disrupted or altered [10, 11]. Bleeding and hematomas are the most frequent complications during thyroidectomy due to the thyroid gland's rich vascular supply, which raises the risk of excessive bleeding [12]. The long-term effects of bleeding remain unclear in clinical observations, but blood loss is typically caused by factors like inadequate vessel compression, poor coagulation, sudden blood pressure increases, or direct damage to thyroid tissue. Neck swelling doesn't always signify significant blood loss; it may simply reflect superficial bleeding in the muscle layers. Over time, hematomas can pose greater risks, especially as bleeding intensifies. These hematomas may not always present with visible swelling, complicating their detection. Pressure within confined neck areas can quickly escalate, leading to respiratory failure or hypoxia, as well as congestion in the larynx and venous-lymphatic obstruction in the trachea. This exacerbates breathing difficulties and increases the risk of hypoxia. Consequently, a deep neck hematoma is considered far more hazardous than one near the surface, particularly since most of these complications arise within the first 24 hours following surgery [13].

In traditional hemostasis procedures, larger vessels are typically ligated, while smaller ones are treated with bipolar coagulation to achieve hemostasis [14]. This approach is generally considered safe and effective, minimizing the risk of nerve and parathyroid damage. On the other hand, monopolar surgery should be avoided due to the elevated temperatures that lead to collateral damage and increased bleeding risks [15]. It has been proposed that ultrasound dissection could help reduce blood loss during both the operation and recovery period, in addition to minimizing thermal injury to vital structures.

Some researchers suggest that using loose sutures with tourniquets for the muscles can help avoid deep hematomas. Postoperative monitoring for 24 hours is recommended for most thyroid surgery patients. If stridor and difficulty breathing occur alongside bleeding, immediate action is required. Reopening the surgical site promptly to drain the accumulated blood, followed by a repeat procedure, is necessary to ensure proper management.

Damage to the recurrent laryngeal nerve (RLN) during thyroid surgery, especially following laryngectomy, has been well-documented. This nerve, a branch of the vagus nerve, innervates all laryngeal muscles except those that control the cricoid muscle. The path of the left RLN is more complex, as it passes under the aortic arch and along the subclavian vein before reaching the neck, where it enters near the thyroid gland. The most common site for RLN injury is near where the nerve enters the larynx. When affected, unilateral nerve damage can cause flaccidity of one vocal fold, leading to dysphonia, which may progress to complete vocal cord paralysis [16]. Repeated damage to the RLN can result in increasingly severe complications. If only one vocal fold is impacted, it may atrophy, diminishing voice quality. Bilateral nerve damage can cause the glottis to close, resulting in biphasic stridor, breathing difficulties, and potentially aphonia, which requires urgent procedures like tracheostomy or intubation [17]. RLN dysfunction can also occur during extubation after total thyroidectomy. However, partial damage may not cause complete paralysis, and symptoms tend to be milder, though they can still present unilaterally or bilaterally. Such nerve injuries can arise from various factors, including poor visibility during surgery, anatomical variations, surgical bleeding, or edema. Monitoring the RLN for damage is crucial, particularly during complex cases involving large goiters, cancer, or repeat surgeries. Studies show that irreversible RLN damage occurs in 0.5 - 5.0% of cases, while temporary damage is observed in 1-30% of patients [18].

Conclusion

Recent improvements in thyroid surgery have led to significant progress in safety and effectiveness, largely due to refined surgical techniques, hemostatic practices, and the incorporation of intraoperative monitoring. Notable among these innovations is the use of recurrent laryngeal nerve monitoring, alongside methods developed for identifying and preserving parathyroid glands. A deep understanding of the anatomy and histology of the cervical region is essential to avoid complications during the procedure. Surgeons must be well-acquainted with the complex structures surrounding the thyroid, including the nerve pathways (specifically the recurrent laryngeal nerve), the parathyroid glands, and their blood supply. Visualization tools have become increasingly important for accurately identifying and protecting these critical structures during surgery. Surgeons aim to avoid any inadvertent damage or removal of these vital components. Real-time intraoperative monitoring allows for immediate assessment of nerve functionality and early detection of any complications. Moreover, meticulous

dissection and careful hemostasis techniques contribute to minimizing bleeding risks and reducing tissue trauma during surgery. By adhering to best practices and utilizing state-of-the-art surgical tools, medical teams can enhance both patient safety and surgical outcomes. It is also important that patients are fully informed about the potential risks and complications before surgery, ensuring they are well-prepared before anesthesia.

Acknowledgments: All authors contributed to the development, methodology, analysis, writing, and editing of the manuscript.

Conflict of Interest: None

Financial Support: None

Ethics Statement: None

References

1. Pastor J, Libánský P, Adámek S, Lischke R, Naňka O. History of thyroid surgery. Rozhl Chir. 2020;99(11):476-80.
2. Hershman JM, Davies TF, Emerson CH, Kopp PA. Retrospective view of thyroid by its former editors. Thyroid. 2020;30(1):2-7. doi:10.1089/thy.2019.0775
3. Orloff LA, Parangi S. History of thyroid surgery in the last century. Thyroid. 2023;33(9):1029-38. doi:10.1089/thy.2022.0629
4. Baloch Z, LiVolsi VA. Fifty years of thyroid pathology: Concepts and developments. Hum Pathol. 2020;95:46-54. doi:10.1016/j.humpath.2019.09.008
5. Dey A. Should seroma be considered a complication? Hernia. 2022;26(1):377-8. doi:10.1007/s10029-021-02385-w 8
6. Nidheesh PV, Gökkuş Ö. Advances in electrocoagulation process. Chemosphere. 2023;310:136779. doi:10.1016/j.chemosphere.2022.136779
7. Kim WW. Transoral thyroidectomy: Advantages and disadvantages. J Minim Invasive Surg. 2020;23(3):112-3. doi:10.7602/jmis.2020.23.3.112
8. Xie H, Xiang Y, Yang E, Zhang H. Factors influencing hypertrophic scarring after thyroidectomy. Adv Skin Wound Care. 2021;34(10):1-6. doi:10.1097/01.ASW.0000775924.92065.78
9. Kim BR, Kwon SH, Kim JW, Jeong WJ, Cha W, Jung YH, et al. Early postoperative injections of polydeoxyribonucleotide prevent hypertrophic scarring after thyroidectomy: A randomized controlled trial. Adv Wound Care (New Rochelle). 2023;12(7):361-70. doi:10.1089/wound.2022.0025
10. Đanić-Hadžibegović A, Hergešić F, Babić E, Slipac J, Prstačić R. Thyroidectomy-related swallowing difficulties: Review of the literature. Acta Clin Croat. 2020;59(Suppl 1):38-49. doi:10.20471/acc.2020.59.s1.05
11. Galluzzi F, Garavello W. Dysphagia following uncomplicated thyroidectomy: A systematic review. Eur Arch Otorhinolaryngol. 2019;276(10):2661-71. doi:10.1007/s00405-019-05599-y
12. Doran HE, Wiseman SM, Palazzo FF, Chadwick D, Aspinall S. Post-thyroidectomy bleeding: Analysis of risk factors from a national registry. Br J Surg. 2021;108(7):851-7. doi:10.1093/bjs/znab015
13. Ortoleva J, Drake FT, Moor A, Ortega R. Hematoma with airway compromise after thyroidectomy. Anesthesiology. 2024;140(1):142-3. doi:10.1097/ALN.0000000000004718
14. Palta S, Saroa R, Palta A. Overview of the coagulation system. Indian J Anaesth. 2014;58(5):515-23. doi:10.4103/0019-5049.144643
15. Czyz CN, Abramowitz BD, Goodman AE, Foster JA, Cahill KV, Everman KR. Infection rates after periocular surgery utilizing new versus re-processed monopolar electrocautery. Surg Infect (Larchmt). 2015;16(3):241-3. doi:10.1089/sur.2014.055
16. Ivey CM. Vocal fold paresis. Otolaryngol Clin North Am. 2019;52(4):637-48. doi:10.1016/j.otc.2019.03.008
17. Liang KY, Scharpf J. Avoiding complications of thyroidectomy: Recurrent laryngeal nerve and superior laryngeal nerve preservation. Otolaryngol Clin North Am. 2024;57(1):75-82. doi:10.1016/j.otc.2023.08.001

18. Nobles ER Jr. Nonrecurrent laryngeal nerve. Arch Surg. 1970;100(6):741-2. doi:10.1001/archsurg.1970.01340240079017