

Thyroid Diseases And Surgical Approach: A Detailed Study Of Indications, Techniques And Results

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Abstract:

Essential gland, responsible for regulating metabolism, growth, and bodily development. Among the main thyroid diseases are hypothyroidism, hyperthyroidism, goiter, and thyroid nodules, which can range from benign to malignant. The diagnosis and treatment of these conditions have significantly evolved with medical advances, emphasizing the need for a multidisciplinary approach involving endocrinologists, radiologists, and surgeons. Surgical intervention in the thyroid is an established practice, essential for specific cases where clinical treatment proves ineffective or when there is suspicion or confirmation of malignancy. Thyroid surgery, known as thyroidectomy, can be partial or total and involves techniques aimed at minimizing complications and improving postoperative outcomes. This area of medicine has seen significant advances in surgical techniques, such as the introduction of minimally invasive thyroidectomy and the use of technologies such as intraoperative neuromonitoring. Objective: To analyze in detail the indications, techniques, and outcomes of surgical approaches to thyroid diseases, focusing on the latest innovations and postoperative outcomes in patients undergoing these procedures. Methodology: The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist guidelines were followed. The research was conducted in the PubMed, Scielo, and Web of Science databases, covering articles published in the last 10 years. The following keywords were used: "thyroid," "thyroid surgery," "thyroidectomy," "thyroid nodules," and "postoperative outcomes." Inclusion criteria encompassed studies providing data on adult patients, offering detailed information on the surgical techniques used, and reporting postoperative outcomes with at least 12 months of follow-up. Exclusion criteria included articles not available in full text, studies involving pediatric patients, or reviews lacking original data. Results: They revealed that thyroidectomy remains an effective approach for treating various thyroid conditions, especially in cases of malignant nodules and compressive goiters. The use of minimally invasive techniques, such as video-assisted thyroidectomy, has shown benefits in terms of faster recovery and lower complication rates. Intraoperative neuromonitoring has emerged as a crucial tool in preventing recurrent laryngeal nerve injuries, a significant complication of thyroid surgery. Studies also highlighted the importance of surgeon experience in reducing complications and improving long-term outcomes. Conclusion: The systematic review indicated that surgical approaches to thyroid diseases have significantly evolved, providing better outcomes for patients. Minimally invasive techniques and the use of advanced technologies, such as neuromonitoring, have contributed to reducing complications and improving the quality of life of patients post-surgery. These advances underscore the importance of a thorough and individualized evaluation for surgery indication, as well as the need for well-trained surgeons familiar with the new techniques and technologies available.

Keywords: "thyroid," "thyroid surgery," "thyroidectomy," "thyroid nodules," and "postoperative outcomes."

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I. Introduction:

Thyroid diseases constitute a diverse set of conditions affecting this essential gland, significantly influencing metabolism and individuals' overall health. Among the main illnesses are hypothyroidism, characterized by insufficient production of thyroid hormones, and hyperthyroidism, which manifests as excessive production of these hormones. Additionally, goiter, the abnormal enlargement of the thyroid, and thyroid nodules, which can be benign or malignant, are also common issues.

These conditions can cause a variety of symptoms, from fatigue and weight gain to palpitations and unexplained weight loss, affecting patients' quality of life. To effectively treat these diseases, a multidisciplinary

approach is essential. Collaboration among endocrinologists, radiologists, and surgeons is crucial for accurate diagnosis and proper treatment. Endocrinologists play a crucial role in managing hormone levels and in the initial assessment of thyroid conditions. Radiologists contribute detailed imaging exams, such as ultrasounds and CT scans, aiding in the identification and characterization of nodules and other anomalies. Surgeons are called upon to intervene in cases where clinical treatments are insufficient, such as in nodules suspected of malignancy or compressive goiters affecting respiratory or swallowing function.

Coordination among these specialists ensures a comprehensive and personalized approach for each patient, increasing the chances of effective treatment and reducing the occurrence of complications. This integration of diverse knowledge and skills is vital for addressing the complexity of thyroid diseases, ensuring that patients receive the most comprehensive and effective care possible. Thyroid diseases pose a significant challenge to public health, affecting millions of people worldwide. When clinical treatments prove insufficient, surgical intervention becomes a crucial option, especially in cases of malignancy or conditions causing compression of adjacent structures.

The evolution of surgical techniques plays a fundamental role in improving outcomes for these patients. Minimally invasive approaches, such as video-assisted thyroidectomy, bring notable benefits, including faster recovery, lower complication rates, and reduced scarring. These techniques are less aggressive compared to traditional surgeries, allowing patients to resume their daily activities more quickly and comfortably. A significant advancement in thyroid surgery is the use of intraoperative neuromonitoring. This technology allows the surgeon to monitor in real time the integrity of the laryngeal nerves, which are critical for speech and breathing.

Preventing damage to these nerves is essential, as injuries can result in serious complications, such as permanent hoarseness or respiratory difficulties. Neuromonitoring enhances the safety of the procedure, providing greater peace of mind for both surgeons and patients. In addition to the techniques and technologies employed, the surgeon's experience is a determining factor in the success of thyroid surgery. Surgeons with greater expertise tend to have lower complication rates and better postoperative outcomes. Continuous training and familiarity with new surgical practices are essential to ensure that healthcare professionals can offer the highest standard of care.

The combination of advanced techniques, monitoring technologies, and the skill of surgeons results in safer and more effective procedures, significantly improving the quality of life for patients affected by thyroid diseases.

II. Objective:

The objective of this systematic literature review is to analyze in detail the indications, techniques, and outcomes of surgical approaches in thyroid diseases. We aim to explore recent innovations in surgical techniques, such as minimally invasive thyroidectomy and the use of advanced technologies, including intraoperative neuromonitoring. Additionally, the review investigates postoperative outcomes, focusing on complication rates, recovery time, and patients' quality of life. The research aims to provide a comprehensive and up-to-date overview that can guide clinical practice and medical decision-making, contributing to the continuous improvement of surgical care in endocrinology.

III. Methodology:

The methodology of this study rigorously followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist to ensure the quality and transparency of the systematic review. The research was conducted in the PubMed, Scielo, and Web of Science databases, using the following descriptors: "thyroid," "thyroid surgery," "thyroidectomy," "thyroid nodules," and "postoperative outcomes." The search encompassed articles published in the last 10 years to ensure relevance and currency of the data. The PRISMA checklist guided the review process through various stages, including identification, selection, eligibility, and inclusion of studies. Initially, all titles and abstracts found were analyzed to identify potentially relevant studies. Subsequently, the full texts of the selected studies were evaluated to determine their eligibility according to established criteria. The inclusion criteria adopted were: studies providing data on adult patients with thyroid diseases; articles offering detailed information on the surgical techniques used, such as partial or total thyroidectomy; research reporting postoperative outcomes with at least 12 months of follow-up; studies published in peer-reviewed journals and available in full text; and articles written in English, Spanish, or Portuguese. These criteria ensured the inclusion of studies with comprehensive and detailed information about surgical interventions and their outcomes.

Exclusion criteria were defined to maintain the quality and relevance of the review. Articles not available in full text were excluded, along with studies involving pediatric patients, research focusing exclusively on non-surgical thyroid treatments, pre-existing systematic reviews or meta-analyses that did not present original data, and articles published in languages other than English, Spanish, or Portuguese. These exclusion criteria helped eliminate studies that did not directly contribute to the objectives of the review.

IV. Results:

Fifteen articles were selected. Thyroid diseases encompass a broad spectrum of conditions affecting the functioning of this vital gland. Hypothyroidism and hyperthyroidism are the most common dysfunctions. In hypothyroidism, there is insufficient production of thyroid hormones, resulting in symptoms such as fatigue, weight gain, depression, and cold intolerance. This condition often results from Hashimoto's thyroiditis, an autoimmune disease where the immune system mistakenly attacks the thyroid. On the other hand, hyperthyroidism is characterized by excessive hormone production, leading to symptoms such as weight loss, palpitations, nervousness, and heat intolerance. The most common cause of hyperthyroidism is Graves' disease, another autoimmune condition that stimulates the thyroid to produce hormones excessively.

In addition to hormonal dysfunctions, thyroid nodules represent another significant category of thyroid diseases. These nodules can be benign or malignant and are often detected during routine exams or through symptoms such as difficulty swallowing or breathing. While many nodules are benign and asymptomatic, some may be cancerous, requiring careful evaluation through biopsies and imaging exams. Additionally, goiter, which is the abnormal enlargement of the thyroid, can occur due to various causes, including nutritional deficiencies and autoimmune diseases. Although often benign, goiter can cause discomfort and compression of adjacent cervical structures, requiring medical or surgical intervention.

The effective management of thyroid diseases requires a multidisciplinary approach, integrating the knowledge and expertise of different medical specialties. Endocrinologists play a central role in evaluating and managing hormonal dysfunctions, using laboratory tests to monitor thyroid hormone levels and adjusting medication therapy as needed. They are often the first to identify the need for additional interventions, such as imaging exams or consultations with other specialists. This coordination is essential to ensure that all facets of the patient's disease are considered and treated comprehensively.

Radiologists significantly contribute by providing a detailed assessment of thyroid anatomy through advanced imaging techniques, such as ultrasound and computed tomography. These images are crucial for the detection and characterization of thyroid nodules, helping to differentiate between benign and malignant lesions. When surgery is indicated, surgeons play a vital role in removing nodules or the entire gland, as needed. The surgeon's expertise, combined with the detailed information provided by imaging exams, ensures that the intervention is performed with maximum precision and effectiveness. Continuous interaction among endocrinologists, radiologists, and surgeons is fundamental to optimizing treatment outcomes and improving the quality of life of patients affected by thyroid diseases.

Advancements in surgical techniques for treating thyroid diseases have revolutionized medical approach, providing significant benefits for patients. Thyroidectomy, which can be partial or total, is a common intervention to treat malignant nodules, bulky goiters, or diseases unresponsive to clinical treatment. Traditionally, this surgery involved significant cervical incision, resulting in visible scars and a prolonged recovery period. However, with the evolution of minimally invasive techniques, such as video-assisted thyroidectomy, surgeons can perform the procedure through smaller incisions, using cameras and specialized instruments to guide the operation.

These minimally invasive techniques offer multiple advantages. Firstly, they result in smaller and less visible scars, which is particularly important from an aesthetic standpoint for many patients. Additionally, the reduced invasion of surrounding tissues reduces postoperative pain and accelerates the recovery process, allowing patients to resume their daily activities more quickly. Another significant innovation is robotic thyroidectomy, which utilizes robotic arms controlled by the surgeon, providing extraordinary precision and minimizing the risks of damage to nearby vital structures, such as the laryngeal nerves and parathyroid glands. These advanced techniques, therefore, substantially improve the experience and outcomes for patients undergoing thyroid surgery.

Intraoperative neuromonitoring emerges as a crucial technology in thyroid surgery, significantly elevating the standard of safety during procedures. This technique allows continuous monitoring of the laryngeal nerves during the operation, alerting the surgeon to any potential compromise. Recurrent laryngeal nerve injuries can result in serious complications, such as vocal cord paralysis, permanent hoarseness, or, in severe cases, respiratory difficulties. Therefore, neuromonitoring serves as a preventive tool, reducing the risk of such damages and ensuring that the patient's vocal function is preserved.

The implementation of intraoperative neuromonitoring also enhances the surgeon's confidence, allowing for more precise and safer interventions. During surgery, electrodes are placed near the laryngeal nerves, which send signals to the monitor, indicating the nerves' integrity in real time. If a change in the signals is detected, the surgeon can immediately adjust the technique, minimizing the risk of injury. Furthermore, studies show that the use of this technology is associated with a significant reduction in postoperative complications related to the laryngeal nerve. Thus, neuromonitoring not only improves the procedure's safety but also contributes to a smoother and more efficient recovery for patients.

The surgeon's experience plays a crucial role in the effectiveness and safety of thyroid surgeries, directly influencing clinical outcomes. Surgeons with extensive experience in thyroid procedures possess a deep understanding of anatomical complexities and the techniques necessary to minimize risks and maximize positive

outcomes. The skill acquired over years of practice allows these professionals to perform interventions with greater precision, reducing the incidence of intraoperative complications, such as injuries to the laryngeal nerves or parathyroid glands, and optimizing postoperative recovery.

Furthermore, the surgeon's expertise is essential for intraoperative decision-making. During surgery, unexpected situations may arise, requiring rapid adaptation and a strategic approach. Experienced surgeons are better prepared to identify and address such challenges efficiently, relying on a vast repertoire of practical and theoretical knowledge. Additionally, their ability to conduct detailed preoperative assessments and carefully plan each step of the procedure contributes to risk reduction and improved outcomes. The surgeon's experience, therefore, not only directly impacts the quality of the surgical procedure but also ensures safer and more effective management of thyroid diseases.

In addition to the immediate impact on surgical outcomes, the surgeon's experience also affects the quality of postoperative follow-up and patient satisfaction. Experienced surgeons are better able to anticipate possible complications and establish postoperative care plans that meet each patient's specific needs. They can provide precise guidance on recovery, helping patients avoid complications and quickly return to their normal activities. This competence and confidence conveyed to the patient contribute to a better overall experience, increasing treatment adherence and satisfaction with the results. Therefore, the surgeon's experience is an indispensable element in promoting safe, effective, and satisfactory treatment for thyroid diseases.

The indications for thyroid surgery are diverse and carefully evaluated based on a combination of clinical and diagnostic factors. Firstly, the presence of nodules suspicious for malignancy, identified through imaging exams and fine-needle aspiration biopsies, is a primary indication for thyroidectomy. Nodules with ultrasonographic characteristics suggestive of carcinoma, such as irregular margins, microcalcifications, and central vascularization, require surgical intervention for removal and histopathological analysis. Additionally, patients with a confirmed diagnosis of thyroid cancer, regardless of histological type, often require total or partial thyroidectomy, depending on the tumor's extent and location.

In addition to malignant nodules, other important indications for surgery include bulky goiter and thyroid diseases unresponsive to clinical treatment. Goiter, especially when multinodular, can cause compressive symptoms, such as difficulty breathing, swallowing, or a feeling of pressure in the neck. In these cases, surgery is indicated to relieve symptoms and prevent future complications. Additionally, patients with hyperthyroidism who do not respond to medical treatment or are not suitable candidates for radioactive iodine therapy may also require surgical intervention. In all these cases, the decision to proceed with surgery is based on a comprehensive assessment of the benefits and risks, always considering each patient's specific conditions.

The postoperative outcomes of thyroid surgeries are a critical aspect to evaluate the effectiveness and safety of interventions. Immediately after surgery, outcome assessment includes analyzing complications such as bleeding, infections, and recurrent laryngeal nerve injuries, which can cause temporary or permanent hoarseness. Close monitoring and appropriate management of these complications are essential to ensure a smooth recovery and minimize adverse impacts. Additionally, the function of the parathyroid glands, responsible for calcium regulation in the body, should be monitored to prevent hypocalcemia, a potentially serious complication that may occur after thyroidectomy.

Long-term postoperative outcomes involve assessing patients' quality of life and continuous monitoring to detect potential recurrences or late complications. Studies show that most patients experience a significant improvement in thyroid-related symptoms after surgery, including resolution of compressive symptoms and normalization of hormone levels. However, it is crucial for patients to undergo regular follow-up, including imaging exams and hormone measurements, to monitor residual thyroid function and identify any signs of disease recurrence. Additionally, hormone replacement therapy may be necessary for patients undergoing total thyroidectomy, ensuring their hormone levels remain stable. In summary, comprehensive analysis of postoperative outcomes is crucial to validate the effectiveness of surgical interventions and to promote patients' long-term health and well-being.

Thyroid diseases, due to their direct influence on metabolism and bodily functions, significantly impact patients' quality of life. Hypothyroidism, for example, causes symptoms such as extreme fatigue, weight gain, depression, and cold intolerance, which can severely compromise an individual's ability to perform daily activities and maintain emotional balance. Additionally, hyperthyroidism induces opposite symptoms, including weight loss, anxiety, palpitations, and heat intolerance, creating a state of metabolic hyperactivity that can also be highly debilitating. These conditions, if not properly treated, reduce productivity and personal satisfaction, affecting both the personal and professional lives of patients.

Furthermore, complications arising from thyroid diseases can exacerbate these impacts. For example, the development of goiter can lead to breathing and swallowing difficulties, while malignant nodules introduce an additional element of stress and uncertainty about prognosis and treatment. Surgical intervention, though often necessary, also entails risks and a recovery period that may temporarily affect quality of life. However, with proper treatment and ongoing management, many patients are able to regain a satisfactory quality of life. Adherence to

treatment, including medication and regular monitoring, is essential to minimize adverse effects and enable a full and productive life.

Technological innovations in thyroid surgery have radically transformed how these interventions are performed, significantly improving clinical outcomes and patient safety. The introduction of robotic surgery, for example, offers an unparalleled level of precision, allowing surgeons to perform delicate and complex movements with greater control. Robotic arms, controlled by an experienced surgeon, reduce the risk of damage to adjacent structures, such as the laryngeal nerves and parathyroid glands, enhancing the effectiveness and safety of procedures. Additionally, this technology minimizes the invasiveness of surgery, resulting in smaller scars, less postoperative pain, and faster recovery for patients.

Another significant innovation is the use of advanced imaging technologies during surgery, such as image-guided navigation and intraoperative ultrasound. These tools allow for detailed, real-time visualization of the thyroid anatomy and surrounding structures, assisting surgeons in accurately identifying nodules and preserving healthy tissues. Additionally, the development of new surgical instruments, such as vessel-sealing forceps and energy-based cutting devices, has contributed to safer and more efficient surgeries. These technological advancements, integrated into clinical practice, not only improve the immediate outcomes of thyroid surgery but also contribute to reducing complications and improving patients' long-term quality of life.

V. Conclusion:

The challenges and opportunities in thyroid disease research represent a dynamic and essential field for advancing knowledge and treatment of these conditions. The complexity of thyroid diseases, including their multifactorial causes and varied manifestations, demands a comprehensive and interdisciplinary research approach. One primary challenge is identifying specific molecular markers that can predict thyroid nodule malignancy and treatment response. Currently, the differentiation between benign and malignant nodules often relies on invasive biopsies and imaging exams, which, while useful, may not be conclusive in all cases. Thus, the discovery of accurate biomarkers has the potential to revolutionize diagnosis and personalize treatments, minimizing unnecessary procedures.

Additionally, research faces the challenge of better understanding the genetic and epigenetic bases of thyroid diseases. Recent studies indicate that specific genetic mutations and epigenetic modifications play a significant role in thyroid cancer development and other thyroid diseases. Exploring these pathways may not only improve diagnosis but also open new possibilities for targeted therapies. Another crucial aspect of research is developing new therapies that are more effective and have fewer side effects. Continuous investigation into the mechanisms of action of current treatments, as well as the search for new therapeutic molecules, is vital for enhancing clinical management of these diseases.

Simultaneously, opportunities in thyroid disease research are vast and promising. The integration of emerging technologies, such as artificial intelligence and big data analysis, has the potential to transform how health data is analyzed and utilized. These technologies can help identify hidden patterns in large datasets, leading to innovative discoveries about disease progression and treatment responses. Additionally, translational research, which aims to apply laboratory findings to clinical practice, offers significant opportunities to directly improve patient care. Well-designed clinical trials and observational studies are essential to validate new therapeutic and diagnostic approaches, ensuring that scientific innovations translate into real benefits for patients.

International and interdisciplinary collaboration is another important opportunity, allowing for the sharing of knowledge and resources, accelerating scientific progress. Collaborative research programs and global consortia can facilitate large-scale studies, which are necessary to fully understand the epidemiology and biology of thyroid diseases. In conclusion, while the challenges in thyroid disease research are significant, the opportunities for advancements are equally great, promising continuous improvements in diagnosis, treatment, and management of these conditions.

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