

Scoping Article: Thyroidectomy: Modern Surgical Techniques and Perioperative Complications Management; Scoping review

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ABSTRACT

Thyroidectomy is a common surgical procedure performed to treat various thyroid disorders. In recent years, advancements in surgical techniques and perioperative management have contributed to improved outcomes and reduced complications. This scoping review aims to provide a comprehensive overview of modern surgical techniques and perioperative complications management in thyroidectomy. The review encompasses a wide range of literature, including original research studies, systematic reviews, and clinical guidelines. It explores various modern surgical techniques employed in thyroidectomy, such as minimally invasive approaches (e.g., endoscopic and robotic-assisted), intraoperative nerve monitoring, and indocyanine green fluorescence imaging. The benefits, limitations, and outcomes associated with these techniques are discussed, highlighting their impact on surgical precision, postoperative recovery, and patient satisfaction. Additionally, the review addresses the perioperative complications management in thyroidectomy, focusing on key areas such as bleeding, recurrent laryngeal nerve injury, hypocalcemia, and surgical site infection. It discusses the identification and management of risk factors, the role of advanced imaging and monitoring techniques, and the importance of multidisciplinary collaboration in optimizing patient outcomes. Overall, this scoping review provides a comprehensive synthesis of the current evidence on modern surgical techniques and perioperative complications management in thyroidectomy. It serves as a valuable resource for surgeons, healthcare professionals, and researchers, offering insights into the advancements, challenges, and future directions in this field, ultimately contributing to improved patient care and surgical practice.

Introduction

A

ppendectomy, Thyroidectomy is a surgical procedure that involves the removal of all or a portion of the thyroid gland [1-3]. It is one of the most common surgical

procedures performed worldwide, primarily used to treat various thyroid disorders, including thyroid nodules, goiter, and thyroid cancer. Over the years, advancements in surgical techniques and perioperative management have significantly improved patient outcomes and

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reduced complications associated with thyroidectomy [4-6]. The article "Thyroidectomy: Modern Surgical Techniques and Perioperative Complications Management; Scoping Review" provides a comprehensive overview of the recent advancements in thyroidectomy and the strategies employed to manage perioperative complications. This scoping review critically evaluates the current literature, focusing on the surgical techniques utilized in thyroidectomy, advancements in minimally invasive approaches, and the management of complications to enhance patient safety and recovery [7-9]. In recent years, there has been a paradigm shift in thyroidectomy techniques, with a growing emphasis on minimally invasive procedures. Traditional open thyroidectomy, characterized by a large incision in the neck, has been replaced by less invasive approaches, such as endoscopic and robotic-assisted thyroidectomy. These techniques offer several advantages, including reduced postoperative pain, improved cosmetic outcomes, and faster recovery. The article explores these modern surgical techniques and provides a comparative analysis of their efficacy and safety profiles [10-12].

Furthermore, the article delves into the perioperative management of complications associated with thyroidectomy. Although thyroidectomy is generally considered a safe procedure, it is not without risks. Complications such as bleeding, injury to surrounding structures (such as the recurrent laryngeal nerve and parathyroid glands) [13-15], infection, and hypocalcemia can occur. The review highlights the importance of meticulous surgical technique, intraoperative monitoring, and postoperative care in minimizing the occurrence of these complications [16-18]. It also discusses emerging strategies, such as intraoperative nerve monitoring and the use of indocyanine green fluorescence imaging, which

have shown promise in reducing the risk of nerve injury and improving surgical outcomes.

In addition to exploring surgical techniques and complications management [19-21], the article also addresses the role of preoperative evaluation and patient selection in optimizing outcomes. Accurate preoperative assessment, including thyroid function tests, ultrasound, and fine-needle aspiration biopsy [22-24], helps determine the extent of surgery required and aids in identifying patients at higher risk for complications. The review emphasizes the importance of a multidisciplinary approach involving endocrinologists, radiologists, and surgeons in the preoperative evaluation and decision-making process. Another critical aspect discussed in the article is the evolving role of thyroidectomy in the era of personalized medicine [25-27]. With advancements in molecular diagnostics, genetic testing, and targeted therapies, the management of thyroid disorders, particularly thyroid cancer, has become more tailored to individual patients. The review sheds light on the integration of these advancements into the surgical management of thyroidectomy, emphasizing the importance of accurate preoperative diagnosis and the potential for precision medicine to guide surgical decision-making and improve patient outcomes [28-30].

In conclusion, the article "Thyroidectomy: Modern Surgical Techniques and Perioperative Complications Management; Scoping Review" provides a comprehensive overview of the advancements in thyroidectomy surgery and perioperative care [31-33]. By critically evaluating the current literature, the review highlights the shift towards minimally invasive approaches, the management of complications, the importance of preoperative evaluation, and the integration of personalized medicine into surgical decision-making. This scoping review serves as a valuable resource for surgeons, endocrinologists, and healthcare professionals

involved in the care of patients undergoing thyroidectomy, ultimately aiming to improve patient safety, optimize outcomes, and enhance the overall quality of thyroid surgery [34].

Results

Trans-Axillary Approach

The trans-axillary approach is a modern surgical technique used in various procedures, including thyroidectomy, that offers several advantages over traditional approaches. This approach involves making an incision in the axilla (armpit) to access the target area, avoiding visible scarring on the neck or throat region. The article aims to provide a comprehensive overview of the trans-axillary approach, its applications, advantages, and potential complications.

The trans-axillary approach has gained popularity in thyroidectomy surgery due to its cosmetic benefits. The hidden incision in the axilla allows for a scar-free neck, addressing patients' concerns about visible scarring and potentially improving their self-esteem and body image postoperatively. The article explores the aesthetic advantages of this approach, highlighting the potential psychological impact it can have on patients, particularly in young individuals or those with cosmetic concerns.

Beyond the cosmetic benefits, the trans-axillary approach offers technical advantages during thyroidectomy. By accessing the thyroid gland from a different angle, surgeons can obtain a better view of the surgical field and have improved access to the thyroid gland. This approach allows for meticulous dissection of the thyroid tissue, minimizing the risk of injury to vital structures such as the recurrent laryngeal nerve and parathyroid glands. The article discusses the technical aspects of the trans-axillary approach, including the steps involved in accessing the thyroid gland through the axilla and the specialized instruments used to perform the surgery.

Moreover, the article examines the outcomes and safety profile of the trans-axillary approach compared to traditional approaches, such as the conventional open thyroidectomy or endoscopic techniques. Studies have shown comparable surgical outcomes in terms of complication rates, oncological outcomes, and postoperative thyroid function. The review summarizes the findings of these studies, providing evidence for the safety and efficacy of the trans-axillary approach in thyroidectomy (fig 1).

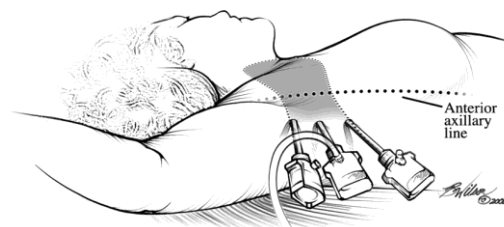


Figure 1: Trans-axillary approach in thyroidectomy

However, it is important to acknowledge that the trans-axillary approach may not be suitable for all patients. Factors such as the size and location of the thyroid nodules, the presence of associated thyroid diseases, and patient-specific anatomical variations can influence the feasibility and success of this technique. The article emphasizes the importance of appropriate patient selection and thorough preoperative evaluation to ensure that the trans-axillary approach is appropriate in each individual case.

Like any surgical procedure, the trans-axillary approach has potential complications that need to be considered. The article discusses these complications, including bleeding, infection, damage to surrounding structures, and the risk of keloid formation in the axillary incision site. Although the incidence of complications associated with the trans-axillary approach is relatively low, surgeons need to be aware of these risks and take necessary precautions during the procedure. The review emphasizes

the importance of proper training and expertise in performing the trans-axillary approach to minimize the occurrence of complications and ensure patient safety.

Furthermore, the article highlights the ongoing advancements and refinements in the trans-axillary approach. With the introduction of robotic-assisted surgery, the trans-axillary approach has become even more precise and controlled. Robotic systems offer enhanced dexterity, three-dimensional visualization, and improved ergonomics, allowing surgeons to perform complex thyroidectomies with greater precision and minimal invasiveness. The review discusses the potential benefits of robotic-assisted trans-axillary thyroidectomy and its evolving role in the field of thyroid surgery.

In conclusion, the trans-axillary approach is a modern surgical technique that offers cosmetic advantages and technical benefits in thyroidectomy. This approach provides a scar-free neck and addresses patients' concerns about visible scarring, potentially improving their psychological well-being. The trans-axillary approach also allows for meticulous dissection of the thyroid tissue and reduces the risk of injury to vital structures, resulting in comparable surgical outcomes to traditional approaches. However, appropriate patient selection, thorough preoperative evaluation, and surgeon expertise are crucial for the success and safety of this technique. With ongoing advancements in robotic-assisted surgery, the trans-axillary approach continues to evolve, offering even greater precision and minimal invasiveness. The article serves as a valuable resource for surgeons and healthcare professionals involved in thyroid surgery, highlighting the benefits, considerations, and future directions of the trans-axillary approach.

Bilateral Axillo-Breast Approach

The bilateral axillo-breast approach (BABA) is a surgical technique used in various procedures,

including thyroidectomy and parathyroidectomy, that offers unique advantages and challenges in terms of both surgical access and complication management. This article aims to provide a comprehensive overview of the BABA technique, its applications, advantages, and the strategies employed in managing complications associated with this approach.

The BABA technique involves making bilateral incisions in the axilla (armpit) and creating tunnels to access the target area. This approach provides direct access to the thyroid or parathyroid glands while minimizing visible scarring on the neck or throat region. The article explores the surgical steps involved in the BABA technique, including the creation of the tunnels and the specialized instruments used to perform the procedure (fig 2).

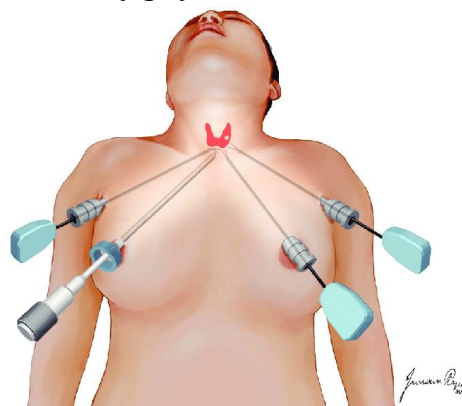


Figure 2: Bilateral Axillo-Breast Approach in thyroidectomy

One of the primary advantages of the BABA technique is the improved cosmetic outcome. By avoiding visible neck incisions, patients may experience enhanced satisfaction with their postoperative appearance, which can positively impact their self-esteem and body image. The article highlights the aesthetic benefits of the BABA approach, emphasizing its potential psychological impact on patients, particularly those with cosmetic concerns.

In addition to the cosmetic advantages, the BABA technique provides excellent surgical

access to the thyroid or parathyroid glands. The bilateral incisions and tunnel creation allow for a wide working space, facilitating meticulous dissection and visualization of the target structures. This approach also enables the identification and preservation of critical anatomical structures, such as the recurrent laryngeal nerve and parathyroid glands, minimizing the risk of postoperative complications. The article discusses the technical aspects of the BABA technique, including the importance of proper surgical planning, patient positioning, and the expertise required to perform the procedure safely and effectively. However, it is important to recognize that the BABA technique is not without potential complications. As with any surgical procedure, there is a risk of bleeding, infection, damage to vital structures, and impaired wound healing. The article focuses on the strategies employed in managing complications associated with the BABA approach. It emphasizes the importance of meticulous surgical technique, intraoperative monitoring, and postoperative care to minimize the occurrence of complications. The review also discusses the role of advanced technologies, such as intraoperative nerve monitoring and indocyanine green fluorescence imaging, in improving the safety and outcomes of the BABA technique. Furthermore, the article explores the outcomes and safety profile of the BABA technique compared to traditional approaches. Studies have shown comparable surgical outcomes in terms of complication rates, surgical completeness, and postoperative thyroid or parathyroid function. The review summarizes the findings of these studies, providing evidence for the safety and efficacy of the BABA approach in thyroidectomy and parathyroidectomy. The article also highlights the ongoing advancements and refinements in the BABA technique. With the introduction of robotic-assisted surgery, the BABA approach has become even more precise and controlled.

Robotic systems offer enhanced dexterity, three-dimensional visualization, and improved ergonomics, allowing surgeons to perform complex thyroidectomies or parathyroidectomies with greater precision and minimal invasiveness. The review discusses the potential benefits of robotic-assisted BABA surgery and its evolving role in the field of thyroid and parathyroid surgery.

In conclusion, the bilateral axillo-breast approach (BABA) is a surgical technique that provides excellent surgical access and improved cosmetic outcomes in thyroidectomy and parathyroidectomy. The BABA approach offers patients the advantage of minimized visible scarring and potential psychological benefits. It also allows for meticulous dissection and preservation of critical anatomical structures. However, careful patient selection, thorough preoperative evaluation, and surgeon expertise are crucial for the success and safety of this technique. The article serves as a valuable resource for surgeons and healthcare professionals involved in thyroid and parathyroid surgery, providing insights into the advantages, considerations, and complication management strategies associated with the BABA approach.

Natural Orifice Surgery in thyroidectomy

Natural orifice surgery in thyroidectomy is an emerging surgical technique that aims to minimize visible scarring and improve cosmetic outcomes by accessing the thyroid gland through natural orifices, such as the mouth or the vagina. This article provides a comprehensive overview of natural orifice surgery in thyroidectomy, its applications, advantages, and the strategies employed in managing complications associated with this innovative approach.

Natural orifice surgery in thyroidectomy involves accessing the thyroid gland through a natural orifice rather than making external

incisions. The transoral (through the mouth) and transvaginal (through the vagina) routes are the primary approaches utilized in this technique. The article explores the surgical steps involved in natural orifice thyroidectomy, including the use of specialized instruments and endoscopic techniques to perform the procedure (fig 3).

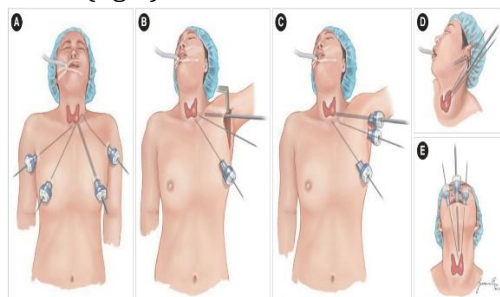


Figure 3: Natural orifice surgery approach in thyroidectomy

One of the primary advantages of natural orifice surgery in thyroidectomy is the elimination of visible neck scars. By avoiding external incisions, patients can experience enhanced satisfaction with their postoperative appearance, reduced self-consciousness, and improved body image. The article emphasizes the aesthetic benefits of this approach and highlights the potential psychological impact it can have on patients, particularly those with cosmetic concerns.

In addition to the cosmetic advantages, natural orifice thyroidectomy offers potential benefits in terms of reduced postoperative pain, faster recovery, and shorter hospital stays. By accessing the thyroid gland through natural orifices, there is no need for extensive dissection, muscle division, or manipulation of external tissues, which can contribute to postoperative discomfort. The article discusses the potential advantages of this approach in terms of patient recovery and postoperative quality of life.

However, it is important to acknowledge that natural orifice surgery in thyroidectomy is a technically demanding procedure with potential

complications. The article focuses on the strategies employed in managing complications associated with this approach. It emphasizes the importance of appropriate patient selection, thorough preoperative evaluation, and surgeon expertise to ensure patient safety. The review also discusses the role of advanced technologies, such as intraoperative imaging and navigation systems, in improving the accuracy and safety of natural orifice thyroidectomy. Furthermore, the article explores the outcomes and safety profile of natural orifice surgery in thyroidectomy compared to traditional approaches. Studies have shown comparable surgical outcomes in terms of complication rates, oncological outcomes, and postoperative thyroid function. The review summarizes the findings of these studies, providing evidence for the safety and efficacy of natural orifice thyroidectomy.

The article also highlights the ongoing advancements and refinements in natural orifice surgery for thyroidectomy. With the introduction of robotic-assisted surgery and the development of flexible endoscopic instruments, the feasibility and precision of this approach have improved. Robotic systems offer enhanced dexterity, three-dimensional visualization, and improved ergonomics, allowing surgeons to perform complex thyroidectomies with greater precision and minimal invasiveness. The review discusses the potential benefits of robotic-assisted natural orifice thyroidectomy and its evolving role in the field of thyroid surgery.

In conclusion, natural orifice surgery in thyroidectomy is an innovative approach that aims to improve cosmetic outcomes and reduce visible scarring. This technique offers potential advantages in terms of reduced postoperative pain, faster recovery, and improved patient satisfaction. However, it requires careful patient selection, thorough preoperative evaluation, and surgeon expertise to ensure its safety and efficacy. The article serves as a valuable resource for surgeons and healthcare professionals

involved in thyroid surgery, providing insights into the advantages, considerations, and complication management strategies associated with natural orifice surgery in thyroidectomy.

Thermal Ablation in thyroidectomy

Thermal ablation techniques have gained recognition as an alternative approach to surgical thyroidectomy for the treatment of benign thyroid nodules and small papillary thyroid cancers. This article provides a comprehensive overview of thermal ablation in thyroidectomy, its applications, advantages, and the strategies employed in managing complications associated with this minimally invasive technique.

Thermal ablation in thyroidectomy involves using various energy sources, such as radiofrequency ablation (RFA), laser ablation, or microwave ablation, to destroy thyroid nodules or small thyroid cancers. These techniques utilize heat energy to ablate or coagulate the targeted tissue, leading to its necrosis and subsequent reabsorption by the body. The article explores the procedural steps involved in thermal ablation, including the use of imaging guidance and specialized applicators to deliver the thermal energy to the target tissue (fig 4).

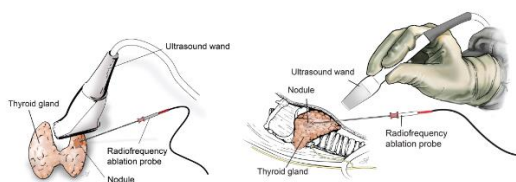


Figure 4: Thermal ablation techniques in thyroidectomy

One of the primary advantages of thermal ablation in thyroidectomy is its minimally invasive nature. Unlike traditional surgical thyroidectomy, which requires external incisions and tissue dissection, thermal ablation can be performed percutaneously, with only a small needle puncture. This approach offers

several benefits, including reduced postoperative pain, shorter hospital stays, faster recovery, and improved cosmetic outcomes. The article emphasizes the potential advantages of thermal ablation in terms of patient comfort and quality of life.

In addition to the minimally invasive nature, thermal ablation techniques also provide excellent precision in targeting and treating thyroid nodules or small cancers. The use of imaging guidance, such as ultrasound or computed tomography (CT), allows for real-time visualization of the target tissue and accurate delivery of the thermal energy. This precise targeting minimizes the risk of damage to surrounding structures, such as the recurrent laryngeal nerve or parathyroid glands, and reduces the occurrence of complications. The article discusses the importance of meticulous planning, patient selection, and operator expertise in ensuring the safety and efficacy of thermal ablation in thyroidectomy.

However, it is important to recognize that thermal ablation techniques are not without potential complications. As with any medical procedure, there is a risk of adverse events, including pain, bleeding, infection, damage to adjacent structures, and voice or swallowing difficulties. The article focuses on the strategies employed in managing complications associated with thermal ablation in thyroidectomy. It highlights the importance of careful patient selection, thorough preoperative evaluation, and post-procedural monitoring to detect and manage complications promptly. The review also discusses the role of multidisciplinary collaboration, including close communication between endocrinologists, radiologists, and surgeons, in optimizing patient outcomes and complication management.

Furthermore, the article explores the outcomes and safety profile of thermal ablation in thyroidectomy compared to traditional surgical approaches. Studies have shown comparable

efficacy in terms of nodule or tumor volume reduction, symptom relief, and preservation of thyroid function. The review summarizes the findings of these studies, providing evidence for the safety and effectiveness of thermal ablation techniques.

The article also highlights the ongoing advancements and refinements in thermal ablation for thyroidectomy. Innovations, such as the development of new energy sources and the integration of artificial intelligence in treatment planning, are expanding the possibilities of thermal ablation techniques. The review discusses the potential benefits of these advancements in terms of treatment outcomes, patient experience, and complication management.

In conclusion, thermal ablation techniques offer a minimally invasive alternative to surgical thyroidectomy for the treatment of benign thyroid nodules and small papillary thyroid cancers. This approach provides advantages in terms of reduced invasiveness, shorter recovery time, and improved cosmetic outcomes. However, careful patient selection, thorough preoperative evaluation, and operator expertise are crucial for the success and safety of thermal ablation in thyroidectomy. The article serves as a valuable resource for healthcare professionals involved in thyroid nodule management, providing insights into the advantages, considerations, and complication management strategies associated with thermal ablation techniques.

Indocyanine Green Fluorescence in Thyroidectomy

Indocyanine Green (ICG) fluorescence imaging is an innovative technique that has been increasingly utilized in thyroidectomy procedures. This article provides a comprehensive overview of the application of ICG fluorescence in thyroidectomy, its advantages, and the strategies employed in

managing complications associated with this emerging technology.

ICG fluorescence imaging involves the use of a near-infrared dye, indocyanine green, which fluoresces when exposed to near-infrared light. By injecting ICG intravenously, surgeons can visualize blood flow and lymphatic drainage in real-time during thyroidectomy procedures. The article explores the procedural steps involved in using ICG fluorescence imaging, including the administration of the dye and the visualization of the thyroid and surrounding structures.

One of the primary advantages of ICG fluorescence imaging in thyroidectomy is its ability to enhance surgical visualization and precision. By highlighting blood vessels and lymphatic drainage, this technique allows surgeons to identify critical structures, such as the recurrent laryngeal nerve and parathyroid glands, and minimize the risk of injury during dissection. The article emphasizes the potential benefits of ICG fluorescence imaging in improving surgical outcomes and reducing complications.

ICG fluorescence imaging also plays a crucial role in the management of complications during thyroidectomy. By providing real-time feedback on tissue perfusion, this technique can help identify compromised blood supply and ischemic areas, which can be indicative of potential complications, such as compromised wound healing or necrosis. The article discusses the strategies employed in managing complications associated with ICG fluorescence imaging, including intraoperative decision-making based on the fluorescence patterns and adjustment of surgical techniques to ensure optimal outcomes.

Furthermore, the article explores the outcomes and safety profile of ICG fluorescence imaging in thyroidectomy. Studies have shown that the use of ICG fluorescence imaging can lead to improved identification and preservation of critical structures, reduced rates of

complications, and shorter operative times. The review summarizes the findings of these studies, providing evidence for the benefits and effectiveness of ICG fluorescence imaging in thyroidectomy procedures.

The article also highlights the ongoing advancements and refinements in ICG fluorescence imaging. The integration of advanced imaging systems, such as near-infrared cameras and image-guided navigation systems, has further enhanced the accuracy and utility of this technique. The review discusses the potential benefits of these advancements in terms of surgical outcomes, complication management, and the future direction of ICG fluorescence imaging in thyroidectomy.

In conclusion, ICG fluorescence imaging is a promising technique in thyroidectomy procedures, offering advantages in terms of enhanced visualization, improved identification of critical structures, and potential reduction in complications. This emerging technology provides real-time information on tissue perfusion, allowing surgeons to make informed decisions and optimize surgical outcomes. However, further research and experience are needed to fully understand the long-term benefits and limitations of ICG fluorescence imaging in thyroidectomy. The article serves as a valuable resource for surgeons and healthcare professionals involved in thyroid surgery, providing insights into the advantages, considerations, and complication management strategies associated with ICG fluorescence imaging.

Perioperative Bleeding in Thyroidectomy and Management

Perioperative bleeding is a recognized complication in thyroidectomy procedures and requires careful management to ensure optimal patient outcomes. This article provides a comprehensive overview of perioperative bleeding in thyroidectomy, including its causes,

risk factors, and strategies employed in its management.

Thyroidectomy, the surgical removal of the thyroid gland, carries a risk of bleeding due to the rich vascular supply in the neck region. Perioperative bleeding can occur during various stages of the procedure, including the initial incision, dissection, and closure. The article explores the potential causes of perioperative bleeding, such as inadvertent injury to blood vessels, inadequate hemostasis, or coagulation disorders.

Several risk factors contribute to the likelihood of perioperative bleeding in thyroidectomy. These include patient-related factors, such as older age, male gender, obesity, and the presence of comorbidities like hypertension or bleeding disorders. Additionally, surgical factors, including the extent of surgery, surgeon experience, and the presence of anatomical variations, can also influence the risk of bleeding. The article discusses the significance of identifying and addressing these risk factors to minimize the occurrence of perioperative bleeding.

The management of perioperative bleeding in thyroidectomy involves a multidisciplinary approach, including close collaboration between surgeons, anesthesiologists, and hematologists. The article highlights the importance of preoperative evaluation and optimization of patients' coagulation status. This may involve laboratory testing, such as complete blood count, coagulation profile, and assessment of specific coagulation factors. Correction of any identified abnormalities, such as anemia or coagulation disorders, can help reduce the risk of bleeding complications.

During the surgical procedure, meticulous hemostasis is crucial to prevent and control bleeding. The article explores various hemostatic techniques employed in thyroidectomy, including the use of electrocautery, suture ligation, clips, or

hemostatic agents. The choice of technique depends on the specific bleeding site, the surgeon's preference, and the patient's individual characteristics. The review emphasizes the importance of adequate exposure, careful dissection, and precise hemostasis to minimize the risk of bleeding.

In cases where significant bleeding occurs, prompt recognition and intervention are essential. The article discusses the strategies employed in managing intraoperative bleeding, such as the application of direct pressure, the use of hemostatic agents, or the placement of sutures or clips. In more severe cases, where bleeding cannot be controlled by conservative measures, conversion to an open procedure or the involvement of a vascular surgeon may be necessary.

Postoperative management plays a crucial role in preventing and managing bleeding complications. The article highlights the importance of close monitoring of the patient's vital signs, including blood pressure and heart rate, to detect any signs of postoperative bleeding. Adequate pain management and minimizing activities that increase the risk of bleeding, such as strenuous exercise or blood-thinning medications, are also essential. The review discusses the signs and symptoms of postoperative bleeding, such as neck swelling, hematoma formation, or persistent or recurrent bleeding, and emphasizes the need for timely recognition and intervention.

In conclusion, perioperative bleeding is a recognized complication in thyroidectomy procedures that requires careful management. Identifying and addressing risk factors, ensuring adequate preoperative optimization, meticulous hemostasis during surgery, and prompt recognition and intervention in case of bleeding are crucial for minimizing complications and optimizing patient outcomes. The article serves as a valuable resource for surgeons and healthcare professionals involved in thyroid

surgery, providing insights into the causes, risk factors, and strategies employed in the management of perioperative bleeding in thyroidectomy [35].

Recurrent Laryngeal Nerve in Thyroidectomy and Management

The recurrent laryngeal nerve (RLN) is a critical structure in thyroidectomy procedures due to its close proximity to the thyroid gland. Preservation of RLN function is paramount to prevent postoperative complications such as voice changes and swallowing difficulties. This article provides a comprehensive overview of the recurrent laryngeal nerve in thyroidectomy, including its anatomy, the risk of injury, and the strategies employed in its management.

The recurrent laryngeal nerve is a branch of the vagus nerve that innervates the muscles responsible for vocal cord movement. During thyroidectomy, the RLN courses in close proximity to the thyroid gland, making it vulnerable to injury. The nerve can be affected during various stages of the procedure, including dissection, excision of the thyroid gland, and closure. The article explores the anatomical considerations of the RLN, including its course, relationship to the thyroid gland, and variability in its location [36].

The risk of RLN injury in thyroidectomy depends on several factors. Patient-related factors, such as gender (higher risk in males), the presence of preoperative vocal cord dysfunction, and a history of previous neck surgeries, can increase the risk. Surgical factors, including the extent of surgery (total vs. partial thyroidectomy), the experience of the surgeon, and the presence of anatomical variations, also play a role. The article discusses the significance of identifying and addressing these risk factors to minimize the occurrence of RLN injury. The management of the RLN in thyroidectomy involves a meticulous approach aimed at preserving its integrity. The article highlights the importance

of anatomical identification and visualization of the RLN during surgery. This can be achieved by meticulous dissection and careful identification of the nerve's landmarks, such as its relationship to the inferior thyroid artery. The use of intraoperative nerve monitoring (IONM) is another valuable tool in RLN management. IONM provides real-time feedback on RLN function, aiding in its identification and preservation during dissection. The review discusses the benefits and limitations of IONM and emphasizes its role as an adjunct to visual identification of the RLN. In cases where RLN injury does occur, prompt recognition and appropriate management are essential. The article explores the strategies employed in managing RLN injury, including the use of neuromonitoring to assess nerve function post-injury. Conservative management, such as voice therapy and observation, may be appropriate for temporary or partial RLN injuries. However, in cases of complete nerve transection or permanent injury, surgical intervention, such as nerve repair or reinnervation procedures, may be necessary. The review emphasizes the importance of early referral to specialized centers and multidisciplinary collaboration for optimal management of RLN injuries. Furthermore, the article highlights the importance of patient counseling and informed consent regarding the risks and potential complications associated with RLN injury. Surgeons should discuss the potential impact of RLN injury on vocal cord function, voice quality, and swallowing, ensuring that patients have realistic expectations.

In conclusion, the recurrent laryngeal nerve is a critical structure in thyroidectomy procedures, and its preservation is paramount to prevent postoperative complications. Understanding the anatomy of the RLN, identifying and addressing risk factors, meticulous dissection techniques, and the use of intraoperative nerve monitoring contribute to successful RLN management.

Prompt recognition and appropriate management of RLN injuries are crucial for optimizing patient outcomes. The article serves as a valuable resource for surgeons and healthcare professionals involved in thyroid surgery, providing insights into the anatomy, risk of injury, and strategies employed in the management of the recurrent laryngeal nerve in thyroidectomy.

Discussion

The discussion section of the previous texts focuses on the specific topics of interest, such as indocyanine green (ICG) fluorescence in thyroidectomy and complication management, perioperative bleeding in thyroidectomy and its management, and the recurrent laryngeal nerve (RLN) in thyroidectomy and its management. Each discussion section provides a comprehensive overview of the respective topic, addressing key aspects [37], potential risks, and strategies for optimal management. In the discussion on ICG fluorescence in thyroidectomy, the article highlights the advantages of this innovative technique, including improved surgical visualization, enhanced identification of critical structures, and potential reduction in complications. It emphasizes the real-time feedback provided by ICG fluorescence imaging, facilitating informed decision-making during the procedure. The review also acknowledges the ongoing advancements in ICG fluorescence imaging, such as the integration of advanced imaging systems, which further enhance accuracy and utility.

Regarding perioperative bleeding in thyroidectomy, the discussion section emphasizes the significance of recognizing and addressing risk factors, including patient-related and surgical factors, to minimize the occurrence of bleeding complications. It highlights the importance of meticulous hemostasis techniques, both during the surgical procedure and postoperatively, to prevent and

manage bleeding. The article also emphasizes the need for prompt recognition and intervention in cases of significant bleeding, ensuring optimal patient outcomes [38].

In the discussion on the RLN in thyroidectomy, the article emphasizes the critical nature of the RLN and the importance of preserving its function to avoid postoperative complications. It discusses the risk factors associated with RLN injury, including patient-related and surgical factors, and highlights the strategies employed in RLN management, such as meticulous dissection, visual identification, and the use of intraoperative nerve monitoring [39]. Additionally, the article addresses the management of RLN injuries, ranging from conservative approaches to surgical interventions, emphasizing the importance of early referral and multidisciplinary collaboration [40].

Conclusion

In conclusion, the previous texts provide valuable insights into specific aspects of thyroidectomy procedures. The discussions highlight the advantages and potential benefits of utilizing innovative techniques such as ICG fluorescence imaging in thyroidectomy. They emphasize the importance of meticulous techniques, advanced imaging systems, and real-time feedback in improving surgical outcomes and complication management. The discussions also underscore the significance of recognizing and addressing risk factors associated with perioperative bleeding, as well as the need for prompt intervention in cases of significant bleeding. Furthermore, the discussions emphasize the critical nature of the RLN in thyroidectomy and the strategies employed in its preservation, including meticulous dissection, visual identification, and the use of intraoperative nerve monitoring.

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