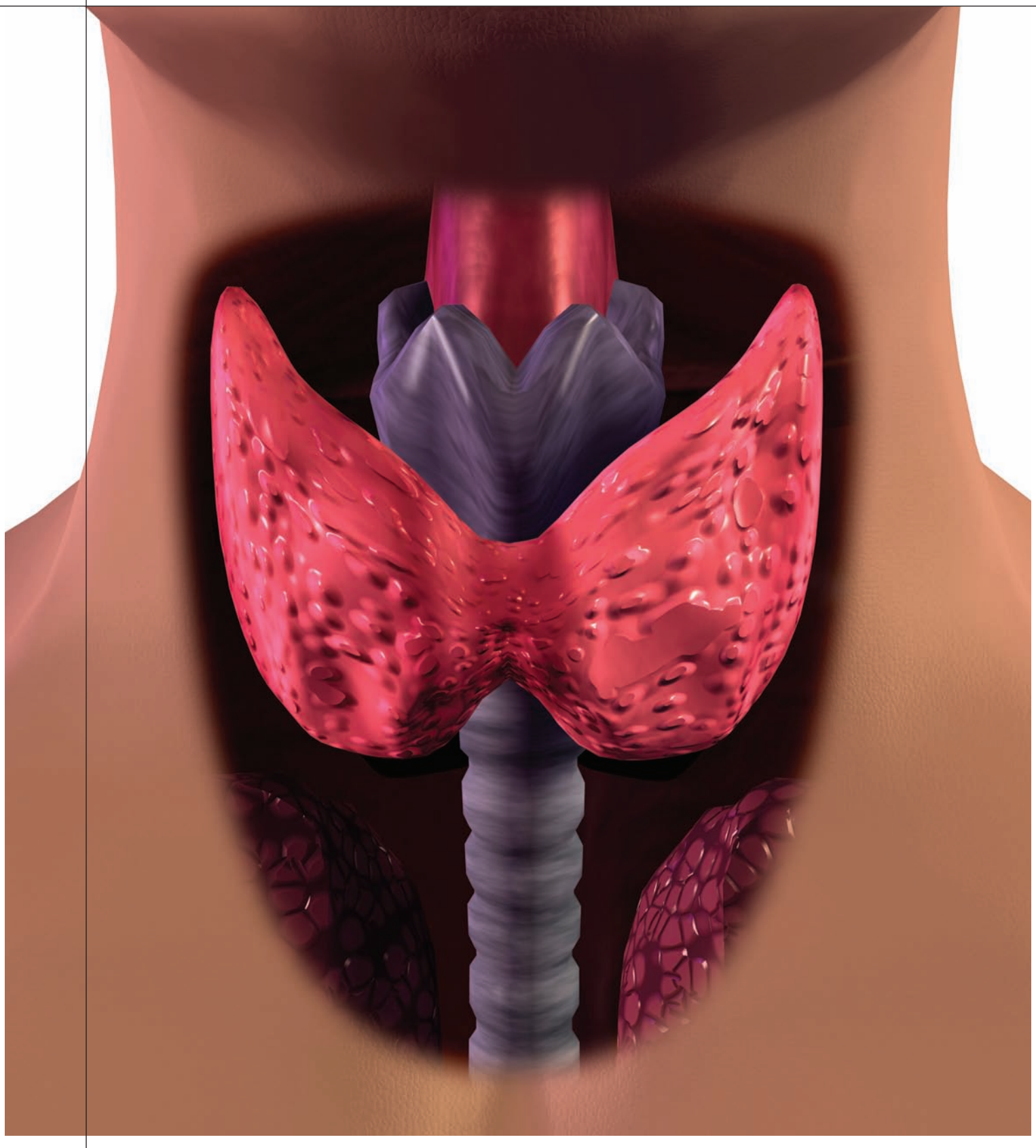

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Little gland, big problems

Thyroidectomy is a surgical intervention most commonly performed for malignant nodules. The perioperative nurse must be aware of the latest approaches and care considerations to ensure positive outcomes and reduce risk of complications.

By Matthew D. Byrne, PhD, RN, CPAN

A 1939 issue of the *American Journal of Nursing* offers an interesting look back at the treatments and care considerations for the patient with thyroid disease. The patient was usually admitted to the hospital 2 to 3 weeks before surgery, and knitting was encouraged as a form of occupational therapy to help divert the patient's thoughts from the impending surgery.[1] Reports about the procedure from the late 1800s indicated high mortality and frequent injury to the laryngeal nerves.[2] Thankfully, the time of large surgical scars (often referred to as collar scars) and extensive hospital stays has long passed; the era of minimally invasive procedures and short-stay surgeries is quickly becoming the rule rather than the exception.

The thyroid gland plays a fascinating role in the maintenance of physiologic homeostasis for many body systems. As a result, alterations in the thyroid gland can have profound physiologic effects, particularly on metabolic functioning. Surgical procedures on the thyroid gland have become very safe despite the importance of surgeon expertise, the complex physiology of the thyroid gland, and the close anatomical proximity of the parathyroid glands (see *Thyroid and parathyroid glands*). Understanding the function of the gland, new frontiers of surgical approaches, and the anatomy of the neck is essential for the perioperative nurse.

Removal of all or part of the thyroid gland is one segment of the treatment plan for patients with alterations in thyroid functioning, particularly in the case of hyperthyroidism as a result of nodule growth. The surgical treatment of thyroid cancer is guided by anatomical location of the nodule, surgeon preference, national guidelines, and pertinent research.

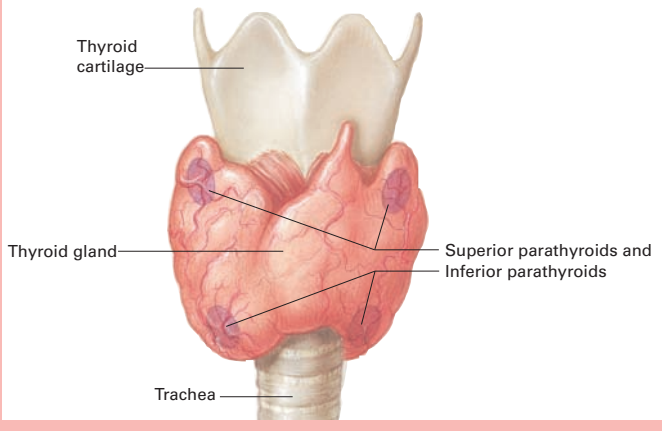
The little gland that could

The thyroid gland has tremendous influence on multiple body systems and plays a role in the synthesis of proteins, metabolism, growth, and development in children. Along with being one of the largest endocrine glands in the body, it also has one of the highest blood flow rates per gram of tissue. Alterations in thyroid function as

Thyroid and parathyroid glands

The thyroid gland is an endocrine gland located in the anterior portion of the neck, just below the larynx. It has two lobes on either side of the trachea that are joined by a narrow band of tissue (known as the isthmus), giving the gland its characteristic butterfly shape.

The parathyroid glands are the body's smallest endocrine glands. The four parathyroid glands are embedded on the posterior surface of the thyroid gland, one in each corner of the thyroid.



Source: The Anatomical Chart Company.

the result of disease or cancer are manifested in the many organs and body systems affected by hormones secreted by the gland (see *Thyroid function*). A patient in a hyperthyroid state, for example, may experience dyspnea, sweating, tremor, diarrhea, fever, tachycardia, palpitations, and even psychiatric disturbances.[3,4] The consequences of the rise in metabolic rate and cardiovascular changes include greater oxygen consumption and production of metabolic waste, which can be life-threatening if unrecognized during the perioperative course.

Thyroid cancer and nodules

The majority of patients with thyroid nodules have few or no symptoms, and nodules are often incidentally discovered during the physical exam.[5] Nodules may be the result of goiter, thyroiditis, cysts, adenomas, carcinomas, lymphoma, or metastatic tumors; according to both European and American Guidelines, malignant and suspicious nodules should be treated surgically.[5,6] Differentiated thyroid cancers (papillary and follicular) represent 90% of all thyroid cancers. Despite trends indicating almost a doubling and tripling of incident rates of these types of tumors in the last 30 years, the American Thyroid Association (ATA) has speculated that this increase represented improved and early detection of nodules and tumors.[6] Malignancy potential has been linked to history of neck radiation, family history of similar conditions, less than 14 or greater than 70 years of age, male gender, specific nodule characteristics (firm, hard, or fixed), and persistent dysphonia, dysphagia, or dyspnea.[5]

ATA guidelines recommend review of history, physical exam, and thyroid-stimulating hormone (TSH) levels for patients with nodules identified via palpation or imaging. A normal or elevated TSH level generally triggers the need for a diagnostic ultrasound, which if positive, is followed by a fine-needle aspiration biopsy. Tissue suspicious for or identified as malignant papillary thyroid cancer is considered for surgical treatment along with certain neoplasms and indeterminate diagnostic cases.[6]

Surgical options may involve a variety of approaches aimed at removing nodules. A complete thyroidectomy may be indicated, which might include removal of the parathyroid glands as well. Subtotal or partial thyroidectomy may also be performed, and removal of portions of the gland (such as the isthmus or lobe) may be indicated. Nodule size staging (if malignant) and presence of goiter may be a few of the factors that have an impact on surgical treatment options and the timing of intervention/presurgical treatment trials.

Preoperative considerations

Generally, a euthyroid state is preferred preoperatively to reduce the risk of perioperative complications, in particular, the emergent hypermetabolic condition known as thyroid storm or thyrotoxic crisis (see *Thyroid storm*). Patients who have been experiencing the hypermetabolic and hyperdynamic symptoms associated with hyperthyroidism may still require preoperative medications for risk reduction. These may include pre- or intraoperative corticosteroid

coverage (such as intravenous dexamethasone), antithyroid medications, and beta-blockers to reduce cardiovascular effects.[7,8] The anesthesia provider will perform a thorough airway evaluation to look for invasive tumor growth or large nodules and to determine the need for special equipment during the case such as neuromuscular monitoring using an electromyographic monitoring device. This monitoring may be utilized to ensure intraoperative integrity of the recurrent laryngeal nerve (RLN), which has the potential to be damaged during the procedural course.[7] Because of the risk of damage to the RLN during the procedure, the perioperative nurse should assess the patient's voice quality preoperatively. Documentation of these findings is important, so that preoperative findings can be compared to the patient's postoperative assessment findings. The perioperative nurse should also address the patient's preoperative concerns (including anxiety) and provide patient teaching instructions for postoperative surgical site care, potential complications, and pain management.

Intraoperative considerations

The surgical approach for conventional thyroidectomy is generally via open transverse neck incision for open cases. A variety of minimally invasive approaches are also becoming increasingly popular. Minimally invasive approaches generally require a suprasternal incision. Local infiltration is often considered to reduce postoperative pain. The technical challenge of the procedure is the often ambiguous looking tissues of the thyroid and parathyroid gland, which may be complicated depending on nodular tumor size. Although blood loss for the procedure should be minimal (less than 100 mL), the vascular nature of the gland and the challenging anatomy of the neck create potential for intraoperative challenges including vessel damage, airway compromise, and nerve damage.

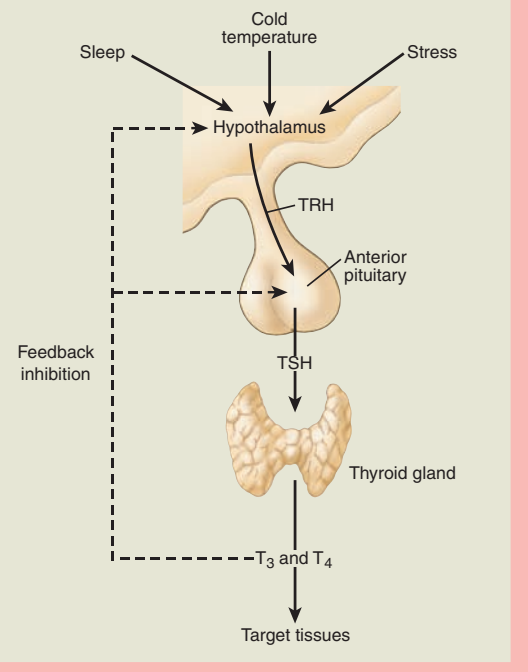
The supine position with moderate extension of the neck is used during conventional thyroidectomy. This extended position optimizes the space between the clavicles and the jaw.[2] Tracheal deviation and thyroid swelling may become more evident depending on the size and invasiveness of the tumor or size of nodule once the patient is positioned correctly. Neck extension should be maintained with placement of a sandbag or pillow.

Thyroid function

The hypothalamic-pituitary-thyroid feedback system regulates the body levels of thyroid hormone. Thyrotropin-releasing hormone (TRH), which is produced by the hypothalamus, controls the release of TSH from the anterior pituitary.

Triiodothyronine (T3) and thyroxine (T4) are two separate hormones (known as thyroid hormone) produced by the thyroid gland. TSH controls the release of T3 and T4 through a negative feedback mechanism:

- If the circulating levels of T3 and T4 are low, the release of TSH is increased
- If the levels of T3 and T4 are elevated, the release of TSH is inhibited.



Source: Porth CM. *Essentials of Pathophysiology Concepts of Altered Health States*. 3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins, 2011, 784.

The placement of surgical drains has been somewhat controversial. Generally, blood loss and postoperative drainage are minimal, which reduces the need for surgical drains. The arguments against the use of drains include findings that they may increase pain, cause scarring, and increase both the total cost of care and length of stay.[9,10] Drains are more likely indicated with extensive tissue involvement due to tumor growth, nodule size, or goiter, which may require greater tissue removal or the creation of a large void space.

Thyroid storm

Thyroid storm is a life-threatening exacerbation of hyperthyroidism that may be induced as a result of surgical stress even in euthyroid patients. Thyroid storm is an emergent hypermetabolic and hyperdynamic state characterized by fever, tremor, sweating, agitation, and confusion. The cardiac effects present the greatest concern and may include tachycardia, hypertension, dysrhythmias, myocardial ischemia, and heart failure.

Management of thyroid storm is focused on reversing the impacts of cardiac and hypermetabolic states. Maintaining hemodynamic stability with fluid resuscitation and beta blockers must be met by replacement and monitoring of electrolytes and acid-base balance. Cooling measures and antithyroid medications are also essential.

Source: Elisha S, Boytim M, Bordi S, Heiner J, Nagelhout J, Waters E. Anesthesia case management for thyroidectomy. *AANA J.* 2010;78(2):151-160.

Present and future surgical options

The conventional open thyroidectomy approach generally involves a lateral incision of 6 to 8 cm in length,[11] which is required for adequate visualization and workspace. Open approaches persist despite emerging preference for use of endoscopic, video-assisted, and/or minimally invasive techniques. The nonconventional techniques of thyroidectomy generally offer the same benefits of any other type of minimally invasive surgical approach, namely reduced length of stay, less pain, reduced size of surgical scar(s), and more cosmetically appealing location of scars. Although appealing, the nonconventional approaches are generally not considered in cases where diffuse disease or a large nodule is present; these approaches are reserved for cases with lower risk and nodules less than 3.5 cm in diameter.[12] The more popular, minimally invasive, video-assisted approach requires a suprasternal notch scar that is generally 1.5 to 3 cm in length.[11] Approaches at sites other than the neck (including extracervical), below the breast, and transaxillary have been discussed in the literature. These techniques have been attempted at various surgical centers[13,14] but may require greater dissection and involve greater risk.[12,15]

Conventional versus minimally invasive

Minimally invasive, video-assisted techniques have been compared to traditional approaches in a number of studies. Gal and associates[16] found that although operative times were longer (65.8 minutes for minimally invasive versus 43.3 minutes for conventional thyroidectomy, *P* less than 0.001), patients were generally more pleased with the cosmetic outcomes. Wu et al.[17] shared their success and supported this approach as effective in treating cancerous nodules with high levels of safety and effectiveness. Robotic-assisted procedures in particular have demonstrated success, despite early trepidation on the part of surgeons.[13] The three-dimensional visualization, especially in a surgical area sensitive anatomy, has also been linked with greater patient satisfaction and less postoperative pain.[18] A detailed overview of the technique by Kuppersmith and Holsinger[14] identified the anatomical challenges and identified an ongoing debate about whether or not carbon dioxide insufflation is required for adequate workspace and visualization during transaxillary robotic-assisted endoscopic thyroid surgery. Typical complications were identified in their review of 31 consecutive cases including neuropraxia in a patient's radial nerve (which eventually resolved), higher than expected blood loss in two patients (greater than 500 mL) and transient vocal cord paresis in one patient, which also resolved. Kuppersmith and Holsinger used an ultrasonic shear device, which has been discussed in the literature as an efficacious means of removing thyroid tissue while reducing the potential thermal damage and smoke plume associated with traditional cauterization methods. A study examining traditional approaches versus the use of an ultrasonic shear device demonstrated that surgical times were decreased using the ultrasonic shear device, particularly with smaller thyroid glands.[19]

Experimental surgical approaches

Cadaveric and early human trials have been utilized for investigating new approaches to thyroidectomy. The use of natural orifices has been explored as a potential surgical approach, as described in a cutting edge case of a transoral approach attempted on cadavers.[20] New frontiers in surgical approaches continue to focus on reducing complication rates but now are targeted on improving patient satisfaction with cosmetic results, reducing complications, and reducing the need for hospital stays. The literature states that because of the challenging anatomy, an experienced surgeon and careful dissection of tissue continue to be heralded as important means of reducing the risk of complications.[2]

Post-op considerations and complications

The postoperative considerations for patients following thyroid surgery include observations for hematoma, respiratory compromise, cardiovascular sequela, hypocalcemia, hypoparathyroidism, and surgical trauma to the RLN. The surgical location and approach (open versus minimally invasive) will dictate the potential for and sites of hematoma development. Open approaches introduce the opportunity for severe hematoma to impede blood flow or compromise breathing. Cardiovascular sequela may manifest as a result of hypocalcemia or thyroid storm (a state of extreme hyperthyroidism). The immediate postoperative care in the postanesthesia care unit includes airway management, pain management, and monitoring the vital signs, oxygen saturation, cardiac rhythm, and the surgical site for any signs of bleeding. The postoperative period should also include an assessment of the patient's voice with a comparison to the pre-op findings as well as noting any hoarseness. Although these may be transient, they may be early indicators of intraoperative damage to the RLN.[7,21] Temporary RLN alterations (usually indicated by hoarseness) have been reported between 3.4% and 7.2%, whereas permanent RLN damage has been reported to be between 0.2% and 0.9%.[21] Specific neuromuscular assessments are also required as a result of intentional/unintentional damage or removal of one or more of the parathyroid glands.

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Evaluation for hypocalcemia

Hypocalcemia is generally the result of secondary damage to or removal of the parathyroid glands, which causes postsurgical acquired hypoparathyroidism resulting in hypocalcemia. Neuromuscular irritability is a rare complication but may still present up to 72 hours post-procedure. A few simple assessments can identify hypocalcemia including the following: evaluation for numbness/tingling in the fingers and toes, circumoral numbness, and the presence of Chvostek sign. Additional signs and symptoms may include change in mental status, muscle cramps or abdominal pain, and ECG changes (QT interval prolongation).[3,7] Chvostek sign is evaluated by tapping the cheek over the facial nerve and then observing for the development of a lip twitch or facial spasm, which is indicative of muscular irritability. Trousseau sign was previously used as an evaluation for hypocalcemia (carpal spasm development when a BP cuff is applied and the circulation transiently occluded) but may be painful and is not preferred. Inattention to these symptoms and unmanaged calcium levels can lead to seizures and/or laryngeal stridor. If hypocalcemia is severe, treatment with I.V. calcium, and monitoring of serum calcium levels have been identified for the immediate postoperative period, while preventive supplementation has also been explored.[22-24]

A positive outlook

Thyroidectomy for treatment of thyroid nodules and hyperthyroid-inducing conditions has been a surgical option of interest for well over 100 years. It will continue to be refined as the new era of robotic and video-assisted techniques allow unprecedented visualization of anatomy and diseased tissue with decreasing need for large or cosmetically unappealing incisions. Patient safety continues to dictate that the perioperative nurse is vigilant, knowledgeable, and capable of managing postoperative complications based on the surgical approach and the extent of nodule involvement. As always, the perioperative nurse is the essential team member who is tasked with balancing the need for efficiency with safety and quality. **OR**

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