

## Emergency Evacuation: Management of an Expanding Neck Hematoma in the PACU

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### Abstract

**Background:** One of the most feared complications of thyroid surgery is an expanding neck hematoma that if not recognized early can result in significant airway obstruction and death. There is little written in the anesthesia literature highlighting the appropriate identification and management of post-operative neck hematomas that may be life threatening.

**Case Presentation:** Here, we present a case of a patient in the PACU that developed an expanding hematoma after thyroidectomy that if not immediately and appropriately managed may have lead to a catastrophic outcome.

**Conclusion:** We discuss the typical presentation, risk factors, preventative measures, early detection strategies and management of patients with neck hematomas that can be a source of significant medicolegal liability that all anesthesiologists and perioperative provider should be aware of.

**Keywords:** Neck Hematoma; Thyroidectomy; Post-Operative Care; Difficult Airway; Medicolegal Liability; PACU

### Abbreviations

ASA: American Society of Anesthesiologists; LMA: Laryngeal Mask Airway; PACU: Post-Anesthesia Care Unit; SBP: Systolic Blood Pressure; LMA: Laryngeal Mask Airway

### Background

"...No sensible man will, on slight considerations, attempt to extirpate a goitrous thyroid gland. If a surgeon should be so adventurous or foolhardy as to undertake the enterprise... Every step he will take will be environed with difficulty, every stroke of his knife will be followed by a torrent of blood and lucky will it be for him if his victim live long enough to enable him to finish his horrid butchery. Should the patient survive the immediate effects of the operation.... Death will be almost certain to overtake him from secondary hemorrhage, or from inflammation of the cervical vessels, esophagus and respiratory organs" - Samuel D. Gross on thyroid surgery in 1866 [1].

Thyroid surgery has come a long way since it was initially performed in the mid 1800s with astounding mortality rate of 40% at that time and the bleeding risk so high that it was condemned by many professional surgical societies [2]. For the surgeons that were brave or foolish enough to attempt such surgeries, they learned quickly that the thyroid gland was to be respected as a highly vascularized structure. Achieving hemostasis during thyroid surgeries was such a great feat that Dr. Emil Kocher won the Nobel Prize in 1909 for his work in

the area thereby reducing mortality in such procedures to less than one percent [2]. The mortality rate now is so low that thyroid surgery is often being performed in the outpatient surgical setting as there becomes a greater emphasis on cost savings and patient satisfaction in today's health care system [3,4]. While neck hematomas are rare, they may be life threatening and associated with significant long-term health consequences, increased economic burden and significant medicolegal liability for anesthesiologists and other perioperative providers. Although neck hematomas are a very well described complication in the surgical literature, there is surprisingly little written in the anesthesia literature regarding their early identification and management-despite that anesthesiologists and other perioperative providers are often directly responsible for the care of these patients in the immediate postoperative period, particularly in the post-anesthesia care unit (PACU). The following case highlights a typical presentation of a postoperative neck hematoma and describes methods for early detection and management of this life threatening complication with the goal to educate perioperative providers and thereby reduce morbidity and mortality.

### Case Presentation

A 36-year-old woman with no significant past medical history underwent a total thyroidectomy with partial neck dissection for papillary thyroid cancer. The case was performed under general anesthesia with an endotracheal tube that was placed easily with direct laryngoscopy. The surgical procedure was notable for a difficult deep dissection of the left upper pole of the thyroid gland and hemostasis was achieved with multiple ligatures and clips. Prior to closing, the neck was irrigated and a Valsalva maneuver was performed while inspecting the surgical field to ensure that no further bleeding was identified. Consistent with the surgeon's regular practice, no drain was left in place. The patient was extubated without any issues with voice intact and she was taken to the PACU with plan for overnight observation. Her early postoperative course was unremarkable with the patient's pain well controlled, hemodynamically stable, breathing comfortably with no supplemental oxygen requirement and there was no notable bleeding and swelling at the surgical incision site. Approximately four hours after surgery, the patient became anxious, tachycardic, diaphoretic and tachypneic with complaints of dysphagia described as a feeling of "something stuck in my throat that I can't clear". These signs and symptoms rapidly progressed to dyspnea and audible stridor. Her surgical dressing was removed and the underlying tissue was found to be firm and fluctuant concerning for expanding hematoma. The surgeons were immediately notified and the patient was emergently brought to an operating room for decompression of her expanding hematoma. The neck was prepped and draped for possible surgical evacuation prior to intubation and the patient was intubated uneventfully with a Glidescope after spontaneously breathing 8% sevoflurane for several minutes. On exploration by a senior surgical resident, there was significant clot below the strap muscles which was carefully washed out and active bleeding was noted from the left upper pole with pressure applied until the primary surgeon arrived, after which hemostasis was achieved after identification and preservation of the left recurrent laryngeal nerve. After ensuring no significant laryngopharyngeal edema with Glidescope exam and an adequate cuff leak, the patient was extubated uneventfully and had an uneventful postoperative course.

### Discussion and Conclusion

This case highlights many important aspects of the presentation, early recognition and management of an expanding hematomas seen after thyroid surgery. The presentation of neck hematoma described can also occur after other operations or procedures involving the neck including anterior cervical discectomy, parathyroidectomy, carotid endarterectomy, central line placement and regional nerve blocks [5,6].

### Timing and presentation of neck hematomas

Several large retrospective studies have reported the incidence of symptomatic hematomas after thyroid and parathyroid surgery to be between 0.1% - 1.5%. The majority of hematomas following thyroidectomies occur within the first six hours, as seen in our case. In a retrospective analysis of 3,086 consecutive patients that underwent thyroidectomy, Lang, *et al.* found that 0.7% developed a postoperative hematoma that required surgical reexploration with the the majority (73%) of the neck hematomas occurring within the first 6 hours after surgery and the remainder occurring by 24 hours. In another retrospective review of 6,830 patients undergoing thyroidectomy in a

single institution, Leyre, *et al* [7]. found the majority (53%) of neck hematomas occurred in the first 6 hours, followed by 37% occurring in 7 - 24 hours and a small minority (10%) occurring after 24 hours. It is important to note that neck hematomas occurring after 24 hours were primarily observed in patients receiving anticoagulation in this study.

A metaanalysis of 10 nonrandomized observation studies comparing outcomes of outpatient (1802 patients) versus inpatient (1136 patients) thyroidectomies, Lee, *et al*. [8] found no significant difference in hematoma formation (0.388% vs 0.704%,  $p = 0.245$ ) and no deaths related to postoperative hematoma formation in the outpatient group that was attributed to likely appropriate patient selection. According to the published American Thyroid Association's statement on outpatient thyroidectomy [9], the relative contraindications to outpatient thyroidectomy include clinical (anticoagulation or antiplatelet therapy, obstructive sleep apnea, uncompensated cardiac or respiratory disease, dialysis for renal failure, seizure disorder, anxiety disorder, hearing loss, visual impairment), social (excessive distance from skilled facility, living alone with no person to accompany, lack of transportation, patient preference, communication barriers) and procedural related factors (massive goiter, extensive substernal goiter, locally advanced cancer, challenging hemostasis, difficult thyroidectomy with hashimoto's thyroiditis or Graves' disease). Eligibility criteria for outpatient thyroidectomy include no major comorbidities (ASA 3 or less), provision and understanding of preoperative education, team approach to education and clinical care, primary care giver willing and available, social setting conducive to safe postoperative management and proximity to skilled facility.

The signs and symptoms associated with developing neck hematomas are wide ranging and may include the obvious such as increased neck swelling, neck firmness, stridor, dyspnea, tachypnea, respiratory distress, tracheal deviation, suture line bleeding and increased drain output if a drain is present. However, signs and symptoms of a neck hematoma may often times be much more subtle and non-respiratory in nature such as tachycardia, sweating, irritability, anxiety and confusion, as well as dysphagia, feeling of neck tightness, neck pain/pressure and changes in voice quality (Table 1).

The variability with which neck hematomas present may be related to their location (superficial vs deep), size and vascular origin (venous vs arterial). Deep hematomas found inferior to the cervical fascia and deep to the strap muscles may result in less noticeable neck swelling than superficial hematomas as less blood accumulation is required to cause significant airway obstruction making them more difficult to detect by observation and palpation. Superficial hematomas arising from directly below the platysma make them more noticeable in terms of neck swelling and require more blood volume to cause airway obstruction. The mechanism by which airway compromise occurs with expanding hematomas is less likely to be due to direct compression of the trachea given the presence of its cartilaginous rings. Rather the hematoma causes supraglottic edema secondary to obstructed venous and lymphatic drainage [10]. In our case, significant supraglottic edema was found on laryngoscopy that was presumed secondary to the finding of the hematoma preventing venous outflow as well as resulting tracheal deviation from the mass effect.

### Risk factors for neck hematomas

A number of possible causes of postoperative neck hematoma have been proposed, including retching and vomiting during recovery, postoperative hypertension, Valsalva maneuver, intraoperative oozing, preexisting coagulopathy and bilateral vs. unilateral thyroidectomy (pmid 20029984). In a retrospective study of 205 patients undergoing thyroidectomy in a single institution, Perera, *et al*. [11] found independent risk factors for post-operative bleeding to include post-operative hypertension (a single SBP recording > 180 mmHg within the first 4 hours post-operatively), diabetes and high post-operative drain output. Preexisting anticoagulation is a factor identified in several studies. In a retrospective study of 4514 patients undergoing thyroid and parathyroid procedures at a single institution, Ottman, *et al*. [12] found that neck hematomas were more likely to occur in patients who were taking anti-platelet or anticoagulant therapy, even if held appropriately for 5 - 7 days prior to surgery, with hematoma formation occurring at a rate of 2.2 and 10.7% for patients who had been receiving anti-platelet or anticoagulant therapy, respectively, compared to a rate of 0.5% overall. In addition, patients who received injectable anticoagulants as a bridge from oral anticoagulation therapy had a 29-fold increased risk for hematoma. Thus, a thrombotic risk assessment should be performed in patients scheduled to undergo thyroid surgery prior to bridging with injectable anticoagulants as bridging may be less indicated for example in patients with atrial fibrillation compared to those with a mechanical mitral valve.

### Intraoperative strategies to prevent neck hematomas

Achieving hemostasis may be challenging in thyroid surgery and the origin of bleeding may at times be difficult to isolate. If the hemodynamics allow, a Valsalva maneuver up to 30 - 40 cm H<sub>2</sub>O may facilitate identification of potential sources of bleeding prior to closure. While some surgeons prefer to operate in the reverse Trendelenburg position to minimize bleeding into the operative field, positioning the patient in the flat or Trendelenburg position may also facilitate additional sources of bleeding [9,13]. The strap muscles are often times loosely approximated at the time of closure with a single-point repair to reduce the risk and delay venous and lymphatic outflow obstruction that may cause airway obstruction [9].

The type of anesthesia employed i.e. general or local anesthesia does not appear to have a significant impact on the rate of hematoma formation [14]. The use of volatile anesthetic vs. total intravenous anesthesia also does not appear to have a significant impact on hematoma formation. Deep extubation has the potential advantage of reducing bucking and coughing that may theoretically reduce hematoma formation, however, interestingly this has not been systematically studied. Deep extubation should be avoided in patients with difficult airways, obstructive sleep apnea and uncontrolled gastric reflux.

### Facilitating early recognition of the neck hematomas

The thyroid surgery patient should be closely monitored postoperatively for the signs and symptoms of an expanding neck hematoma as described above. Of note, the nonspecific signs and symptoms may be dismissed by perioperative providers yet may often times be the only early clinical indicators of an expanding neck hematoma as seen in our patient who initially presented with anxiety, tachycardia, diaphoresis and dysphagia.

It is important to be able to directly visualize the surgical site as increased fluctuance and firmness may be easier to assess on visual and tactile assessment without an overlying dressing. If a dressing must be used, a small incisional dressing rather than a bulky gauze is preferable. Pressure dressings have not been demonstrated to reduce to occurrence of post-operative hematomas and may prevent earlier detection. Measurement of neck circumference is performed in some institutions but may not be effective since airway compromise may occur before there is an objective change in measurement. Nonetheless such protocols may encourage more frequent tactile monitoring and observation of the surgical site. Ultrasound may have a role in monitoring for neck hematomas, but it has not been systematically studied in this setting [15,16].

While drains might be expected to reduce the risk for neck hematoma in routine thyroid surgeries, they have not been demonstrated to reduce the risk for neck hematomas development and need for neck reexploration. This lack of benefit may result from drain blockage resulting from clotted blood [17]. Drains have have been linked to other effects postoperatively including increased risk for infection, post-operative pain, hospital length of stay and hospital cost.

### Urgent vs emergent evacuation of the expanding hematomas

If a patient is not in respiratory distress and signs of airway compromise, it may be acceptable to move expeditiously to the operating room to secure the airway and perform an exploration and evacuation of the neck hematoma in a controlled setting. Neck hematomas can progress rapidly from partial to total airway obstruction and require a high level of urgency to evacuate even if the respiratory status at present appears stable-a point that cannot be emphasized enough. If an OR cannot be secured emergently or that patient has signs of airway compromise, then preparations should be made to evacuate the hematoma at the bedside and secure the airway

Securing an airway prior to bedside evacuation depends a number of factors including the degree of respiratory compromise on the experience of the providers, the availability of specialized airway equipment, as well as the feasibility of performing a surgical airway in a "cannot intubate and ventilate" scenario. In the case of our patient, we had immediate availability of a nearby OR and transferred the patient with all necessary emergency airway equipment, drugs, supplies and the necessary support staff present.

**Airway management of the expanding hematoma**

Early recognition through close observation as well as preparation is critical to the successful management of an expanding neck hematoma (Table 1 and 2). The following should be readily available near the bedside:

1. Emergency difficult airway equipment (videolaryngoscopes, fiberoptic scope, direct laryngoscopes, bougie, laryngeal mask airway (LMA), endotracheal tubes of varying sizes, exchange catheters).
2. Supplies to perform an emergent surgical airway (scalpel, cricothyrotomy kit, tracheostomy kit).
3. Supplies to open the incision site and evacuate the hematoma to decompress the airway (aseptic solutions, sterile gloves, sterile saline irrigation solution, sterile suture removal kits, sterile scissors).

Nonspecific (often early) Signs	Respiratory (often later) Signs
Change in voice quality	Dyspnea
Neck tightness	Tachypnea
Neck pain/pressure	Tracheal deviation
Neck swelling	Stridor
Dysphagia	Hypoxia
Tachycardia	Respiratory distress
Sweating	
Irritability	
Agitation	
Anxiety	
Suture line bleeding	

**Table 1:** Signs and symptoms of an expanding neck hematoma.

Management Considerations
<ul style="list-style-type: none"> <li>• Early recognition is critical. The signs and symptoms (left panel) are often very subtle. The primary clinician and surgeon should be immediately assess the patient at bedside when notified of such signs and symptoms.</li> <li>• Emergency airway equipment and supplies for emergent decompression and surgical airway readily available.</li> <li>• (videolaryngoscopes, fiberoptic scopes, direct laryngoscopes, bougie, LMAs, endotracheal tubes of varying sizes, exchange catheters, aseptic solutions, sterile gloves, sterile saline irrigation solution, sterile suture removal kits, sterile scissors, scalpel, cricothyrotomy kit, tracheostomy kit)</li> <li>• Hematoma formation may lead to rapid airway compromise. Serious consideration for securing the airway at bedside should be made even if the patient is stable. The most experienced laryngoscopist in the facility should secure the airway ideally with the patient spontaneously breathing.</li> <li>• Neck should be prepped and draped prior to securing the airway for emergent decompression and surgical airway.</li> <li>• Consider decompression of hematoma at bedside prior to laryngoscopy or after failed initial laryngoscopy attempt to facilitate glottis visualization and intubation.</li> <li>• It is not sufficient to just open the incision site. The deeper planes of tissue must be irrigated to effectively evacuate clots and relieve airway obstruction.</li> <li>• Strong consideration for surgical airway if initial attempt at intubation is not successful and/or ventilation is increasingly difficult.</li> </ul>

**Table 2:** Management Considerations for the patient with an expanding neck hematoma.

While prior intubation history should be taken into consideration, the laryngoscopist should expect and be prepared for a difficult airway and the potential need for a surgical airway given the risk for significant airway edema. The most experienced laryngoscopist should perform the intubation as multiple attempts may worsen preexisting airway edema make it difficult to pass an endotracheal tube despite adequate visualization. In addition, it is important to be prepared with smaller sized endotracheal tubes and exchange catheters.

Serious consideration should be given to maintaining spontaneous ventilation and avoiding paralysis prior to securing the airway. Ketamine may be an ideal agent to provide sedation while spontaneous ventilation is maintained. A Sevoflurane inhalation induction as used in our case can also provide adequate intubating conditions with spontaneous breathing [18], however, this technique requires several minutes to achieve ideal intubating conditions. While sevoflurane does not significantly suppress spontaneous ventilation, it may reduce skeletal muscle tone in which may contribute to airway obstruction. Awake intubations either with a fiberoptic endoscope and/or video laryngoscopy are generally well tolerated if the airway is well topicalized time permitting. Keeping the patient in a sitting position may be beneficial for airway patency as further airway compression may result if the patient is laid supine.

Attempts at blind intubation are unlikely to be successful given the potential for significant airway swelling and can result in airway trauma, increase laryngeal edema and further airway compromise. If the airway does become bloody, videolaryngoscopy is less likely to be successful. If the initial laryngoscopy attempt is difficult, emergent decompression has been found to not only facilitate glottic visualization and successful intubation [19], but also to improve hypoxemia and cardiovascular instability [20]. Additional failed attempts at laryngoscopy without hematoma evacuation may further compromise hemodynamic instability and the airway to the point of total obstruction.

The neck should always be prepped and draped prior to securing the airway in case of need for emergent decompression and surgical airway. All instruments for cricothyrotomy and tracheostomy should be readily available and there should be strong consideration for an surgical airway if the initial attempt at intubation are not successful and/or ventilation is increasingly difficult. While a number of techniques have been described for establishing a surgical airway, for practitioners who are not facile with performing emergent surgical airways, the fastest and easiest approach to performing successful cricothyrotomy is likely the scalpel, bougie and endotracheal tube technique.

After hematoma evacuation special consideration is required prior to extubation given that residual airway edema may be present. The patient should only be extubated if they satisfy standard extubation criteria including an adequate cuff leak. The airway may also be evaluated via direct or video laryngoscopy prior to extubation to allow direct visualization of the airway for the presence of laryngopharyngeal edema. Dexamethasone may be administered to reduce post-operative airway swelling and has been shown to reduce post-operative pain and nausea.

### **A practical approach to bedside evacuation of the expanding hematoma**

Sterile technique should be used when possible including the use of aseptic solutions, sterile gloves, sterile saline irrigation solution, sterile instruments (i.e. suture removal kits, scissors) to open the incision site. In order to relieve airway obstruction, it may not be sufficient to solely open the superficial surgical incision site but entry into deeper tissues planes may be necessary to effectively evacuate obstructive clots– a point that is not well known to even many senior and experienced perioperative providers. Suctioning should be done gently if required so as not to injure any significant neurovascular structures. Once the clots are evacuated, gentle pressure can temporize bleeding while the patient is transferred to a more controlled setting such as the operating room to obtain further definitive control of bleeding by the surgical attending. Blind ligation, cauterization and clipping of structures should be avoided as this may cause potential vascular and nerve injury.

As thyroidectomies becoming increasingly routine procedures, many centers have reduced their lengths of stay in the recovery room and the hospital. Postoperative hemorrhage is an infrequent but well-known complication following thyroid surgery that can rapidly lead

to life-threatening, acute airway obstruction. Consequently, increased understanding of the risk factors, signs and symptoms and management strategies of patients with expanding neck hematomas will improve patient outcomes and minimize medicolegal liability.

### Declarations

#### Ethics Approval and Consent to Participate

Not applicable. Consent was not obtained as no images, videos and other patient identifiable details were reported within the manuscript.

#### Consent for Publication

Not applicable. Consent was not obtained as no images, videos and other patient identifiable details were reported within the manuscript.

#### Availability of Data and Material

Not applicable.

#### Competing Interests

The authors declare that they have no competing interests.

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#### Authors' Contributions

EAB and SMB were responsible for the conception of this work. MGC, EAB and SMB contributed towards the writing and editing of the manuscript. All authors read and approved the final manuscript.

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