

MANAGEMENT of COMPLICATIONS after THYROID SURGERY

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OUTLINE



01 INTRODUCTION: THYROID SURGERY

02 COMPLICATIONS after THYROID SURGERY
Hypocalcemia and Hypoparathyroidism, Nerve Injury, Bleeding



01

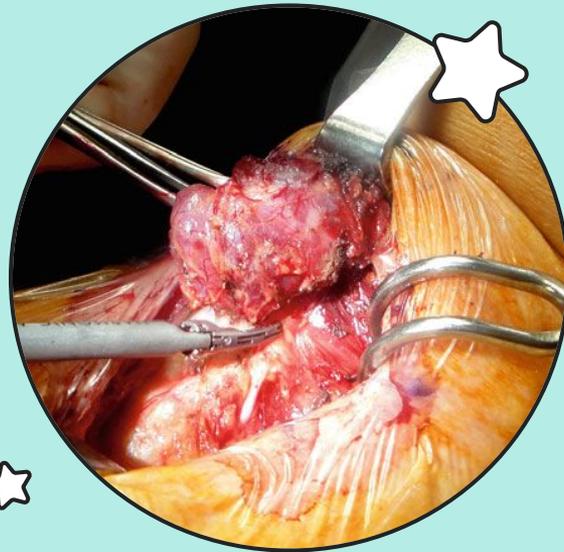
**INTRODUCTION:
THYROID SURGERY**

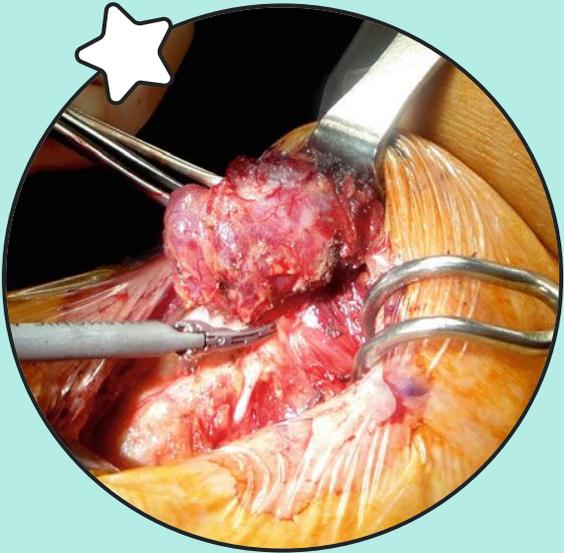


THYROIDECTOMY

Definition:

Operation wherein whole or part of thyroid gland is removed





THYROIDECTOMY

Purpose:

Performed for hyperfunction, structural diseases that cause *compression, cosmetic problems*, and for *existing or risk of malignancy*



INDICATION for THYROID SURGERY

1. Existence or suspicion of malignancy
2. Local compressive symptoms with respect to airway and/or foodway
3. Cosmetic deformity of neck by large thyroid
4. Control of hyperthyroidism either primarily or because of failure of medical management

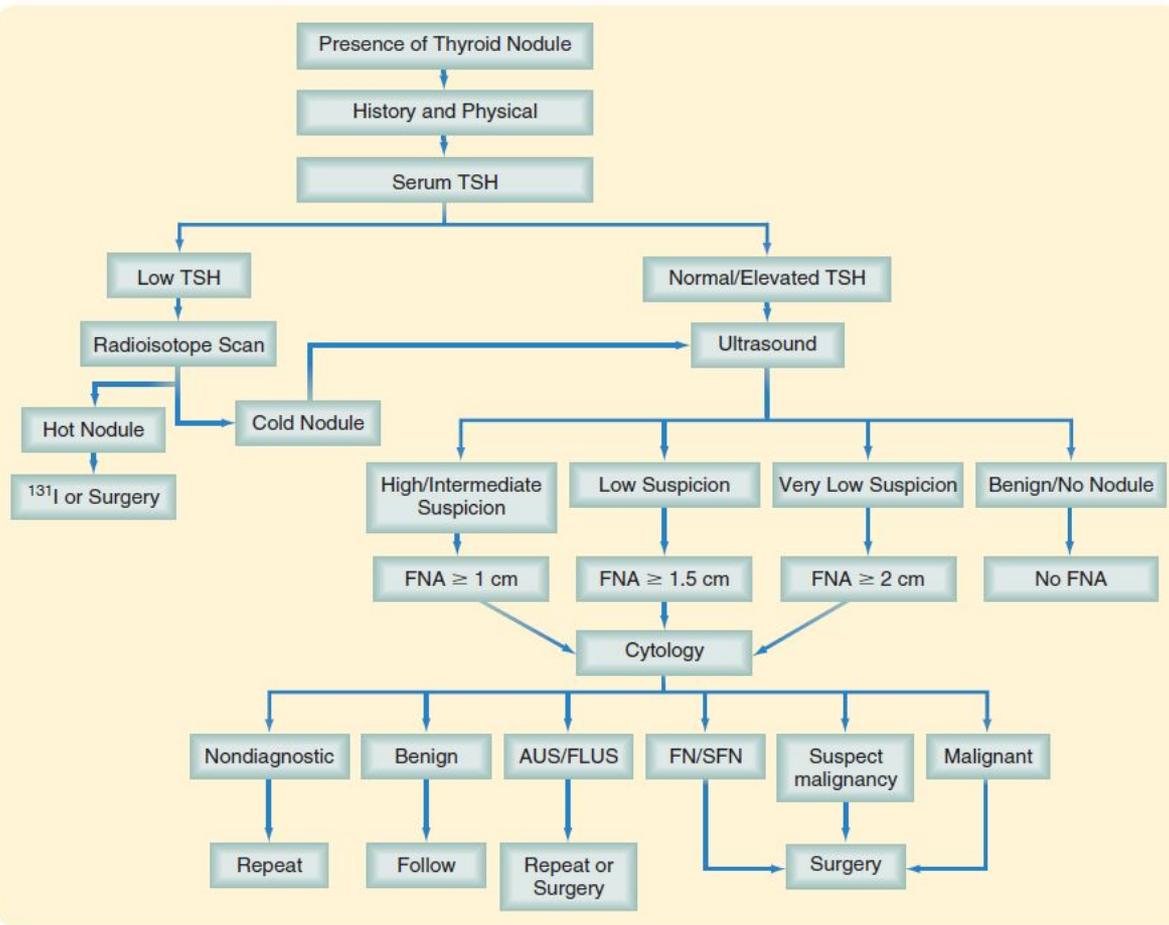


FIGURE 36-8 Workup of a thyroid nodule. *AUS*, atypia of undetermined significance; *FLUS*, follicular lesion of undetermined significance; *FN*, follicular neoplasm; *FNA*, fine-needle aspiration biopsy; *SFN*, suspicious for follicular neoplasm; *TSH*, thyroid-stimulating hormone.

Table 7.1 Clinical manifestations of hypothyroidism and hyperthyroidism

Hypothyroidism	System affected	Hyperthyroidism
Weight gain Fatigue Cold intolerance and hypothermia Hyponatremia Elevation of creatine phosphokinase	General	Weight Loss Heat intolerance Anxiety/nervousness Insomnia Muscle weakness
Dry and coarse skin, pretibial myxedema (non-pitting edema) Dry and coarse hair Hair loss	Skin	Excess perspiration Palmer erythema
Goiter Hoarse voice Enlarged tongue Periorbital edema	Head and Neck	Ophthalmopathy (Graves' disease only: proptosis and chemosis)
Constipation	Gastrointestinal	Frequent stools/diarrhea
Myalgia Muscle cramps Carpel tunnel syndrome	Musculoskeletal	Tremor
Depression Decreased concentration Dementia	Nervous System	Anxiety/nervousness Hyperkinesia
Irregular menstrual periods/amenorrhea Menorrhagia Galactorrhea with elevated prolactin levels Infertility Increase risk of miscarriage	Reproductive	Irregular menstrual periods/amenorrhea Light menstrual flow Infertility Gynecomastia (males)
Bradycardia Decreased cardiac output Reduced blood volume Abnormal baroreceptor function Hypercholesterolemia Pericardial effusion Congestive heart failure Increased peripheral vascular resistance	Cardiovascular	Tachycardia Increased myocardial contractility Arrhythmias Cardiomegaly Increased cardiac output Palpitations Dyspnea on exertion Bounding pulses Atrial fibrillation

Thyroid surgery: indication and operation sequence; audit years 2016-2020

Indication	Operation sequence				
	First-time surgery		Redo surgery		Unspecified
	Count	Percent	Count	Percent	Count
Biopsy result	11,668	38.0%	387	13.0%	2
Clinically worrying lesion	3,457	11.3%	128	4.3%	2
Completion thyroidectomy for cancer	873	2.8%	1,540	51.6%	0
Compressive symptoms	7,396	24.1%	492	16.5%	1
Quality of life	797	2.6%	36	1.2%	0
Recurrent cancer	57	0.2%	292	9.8%	0
Recurrent cyst	516	1.7%	15	0.5%	0
Thyroglossal cyst	153	0.5%	12	0.4%	0
Thyrotoxicosis	5,775	18.8%	84	2.8%	2
Unspecified	822		67		1,630
All	31,514		3,053		1,637



Figure 7.1 A case of large right-sided goiter.



Figure 7.2 Left-sided deviation of the trachea.



Figure 7.3 (a and b) Tracheal compression by retrosternal goiter.



Figure 7.4 Large goiters present an airway risk.



Figure 7.6 Malampatti grading of patient.

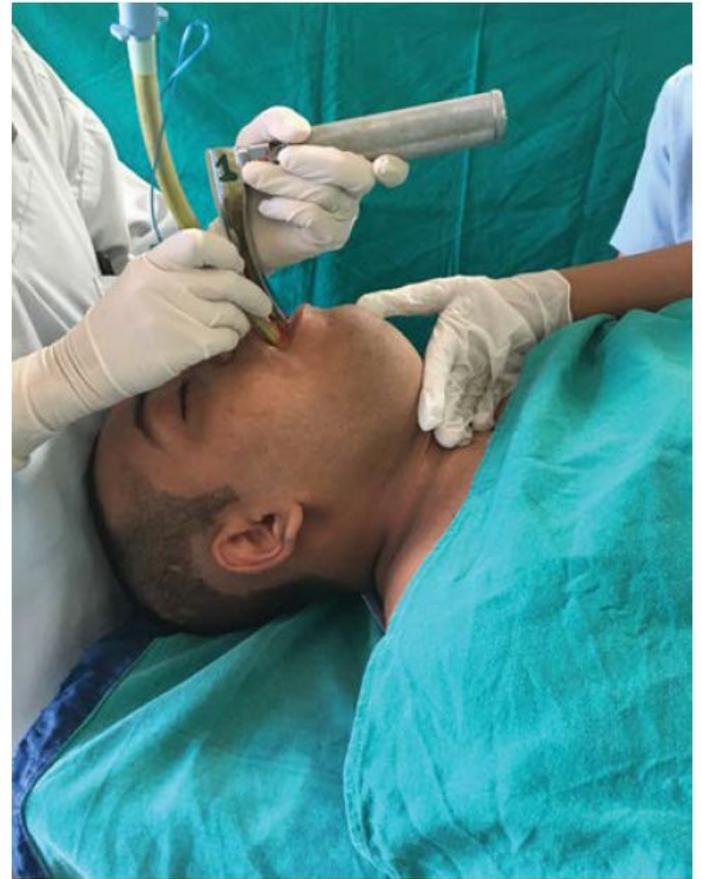


Figure 7.5 External manipulation of neck during laryngoscopy.

Difficult Airway Society guidelines for awake tracheal intubation (ATI) in adults

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Ergonomics for ATI

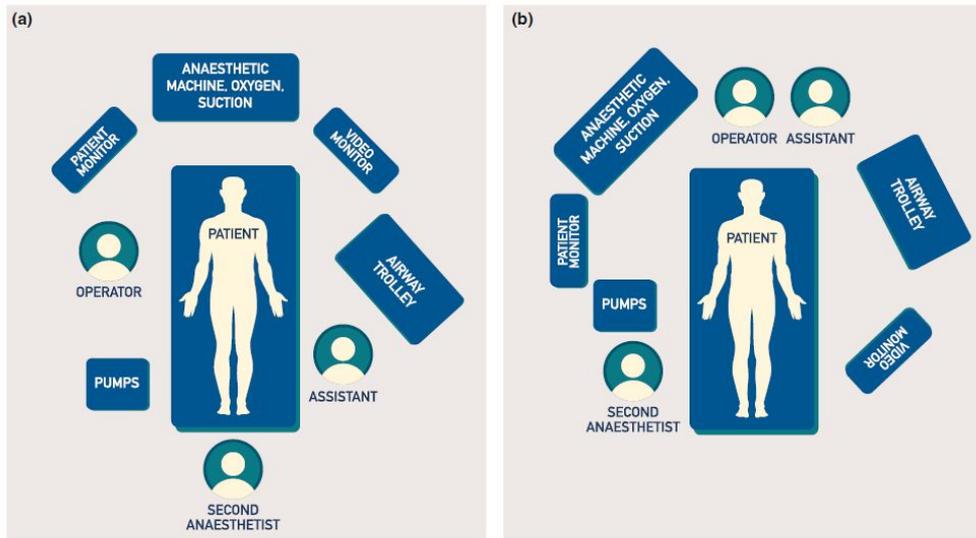


Figure 1 Examples of ergonomics for awake tracheal intubation (ATI). The primary operator should have a direct line of sight of the patient, video monitor and patient monitor, as well as immediate access to infusion pumps, anaesthetic machine, suction and oxygen delivery device. If a second anaesthetist is present, they should be positioned with a direct line of sight of the patient and have immediate access to infusion pumps, as well as be able to access all other equipment. The anaesthetic assistant's primary position should be with immediate access to the airway trolley, and in proximity to the operator. (a) Awake tracheal intubation performed with the operator positioned facing the patient who is in a sitting up position. (b) Awake tracheal intubation performed with the operator positioned behind the supine/semi-recumbent patient. This figure forms part of the Difficult Airway Society guidelines for ATI in adults and should be used in conjunction with the text. ©Difficult Airway Society 2019.



DAS ATI technique



OXYGENATE

- Apply HFNO early
- Titrate HFNO from 30–70 L min⁻¹
- Continue HFNO throughout procedure

TOPICALISE

- Lidocaine 10% spray to oropharynx, tonsillar pillars, base of tongue
- 20–30 sprays (during inspiration, over 5 min)
- If nasal route: co-phenylcaine spray
- Test topicalisation atraumatically
- If inadequate, re-apply LA up to maximum dose:
 - Further 5 sprays of lidocaine 10% to tongue base
 - 2 ml lidocaine 2% (x 3) spray above, at and below vocal cords via epidural catheter/working channel of FB or using MAD

Lidocaine

- 1 spray (0.1 ml) of 10% = 10 mg
- 1 ml of 2% = 20 mg

Co-phenylcaine

- 2.5 ml = 125 mg lidocaine + 12.5 mg phenylephrine

PERFORM

- Select appropriate tracheal tube
- Patient sitting up
- Ensure operator can readily see patient monitor, infusion pumps and video screen
- Clear secretions
- For ATI:FB
 - Operator positioned facing patient
 - Consider bronchoscope airway if oral route
 - Bevel facing posteriorly
- For ATI:VL
 - Operator positioned behind patient
 - Consider bougie
- Before induction of anaesthesia: two-point check

SEDATE

- Sedate if required
- Remifentanyl TCI (Minto) Ce 1.0–3.0 ng·ml⁻¹
- If second anaesthetist present, consider adding midazolam 0.5–1 mg

Figure 2 The Difficult Airway Society awake tracheal intubation (ATI) technique. This figure forms part of the Difficult Airway Society guidelines for ATI in adults and should be used in conjunction with the text. HFNO, high-flow nasal oxygen; LA, local anaesthetic; FB, flexible bronchoscopy; MAD, mucosal atomising device; TCI, target-controlled infusion; Ce, effect-site concentration; VL, videolaryngoscopy. ©Difficult Airway Society 2019.

Management of unanticipated difficult tracheal intubation in adults

Plan A: Facemask ventilation and tracheal intubation

Optimise head and neck position
 Preoxygenate
 Adequate neuromuscular blockade
 Direct / Video Laryngoscopy (maximum 3+1 attempts)
 External laryngeal manipulation
 Bougie
 Remove cricoid pressure
 Maintain oxygenation and anaesthesia

Succeed →

If in difficulty → call for help

Confirm tracheal intubation with capnography

↓ Declare failed intubation

Plan B: Maintaining oxygenation: SAD insertion

2nd generation device recommended
 Change device or size (maximum 3 attempts)
 Oxygenate and ventilate

Succeed →

STOP AND THINK

Options (consider risks and benefits):

1. Wake the patient up
2. Intubate trachea via the SAD
3. Proceed without intubating the trachea
4. Tracheostomy or cricothyroidotomy

↓ Declare failed SAD ventilation

Plan C: Facemask ventilation

If facemask ventilation impossible, paralyse
 Final attempt at facemask ventilation
 Use 2 person technique and adjuncts

Succeed →

Wake the patient up

↓ Declare CICO

Plan D: Emergency front of neck access

Scalpel cricothyroidotomy

Post-operative care and follow up

- Formulate immediate airway management plan
- Monitor for complications
- Complete airway alert form
- Explain to the patient in person and in writing
- Send written report to GP and local database

This flowchart forms part of the DAS Guidelines for unanticipated difficult intubation in adults 2015 and should be used in conjunction with the text.



CONTRAINDICATION for THYROID SURGERY

- “Thyroidectomy should not be performed on patients whose *medical condition is so poor* that they will not tolerate anesthetic or surgery”
- 

02

**COMPLICATIONS
after THYROID SURGERY**



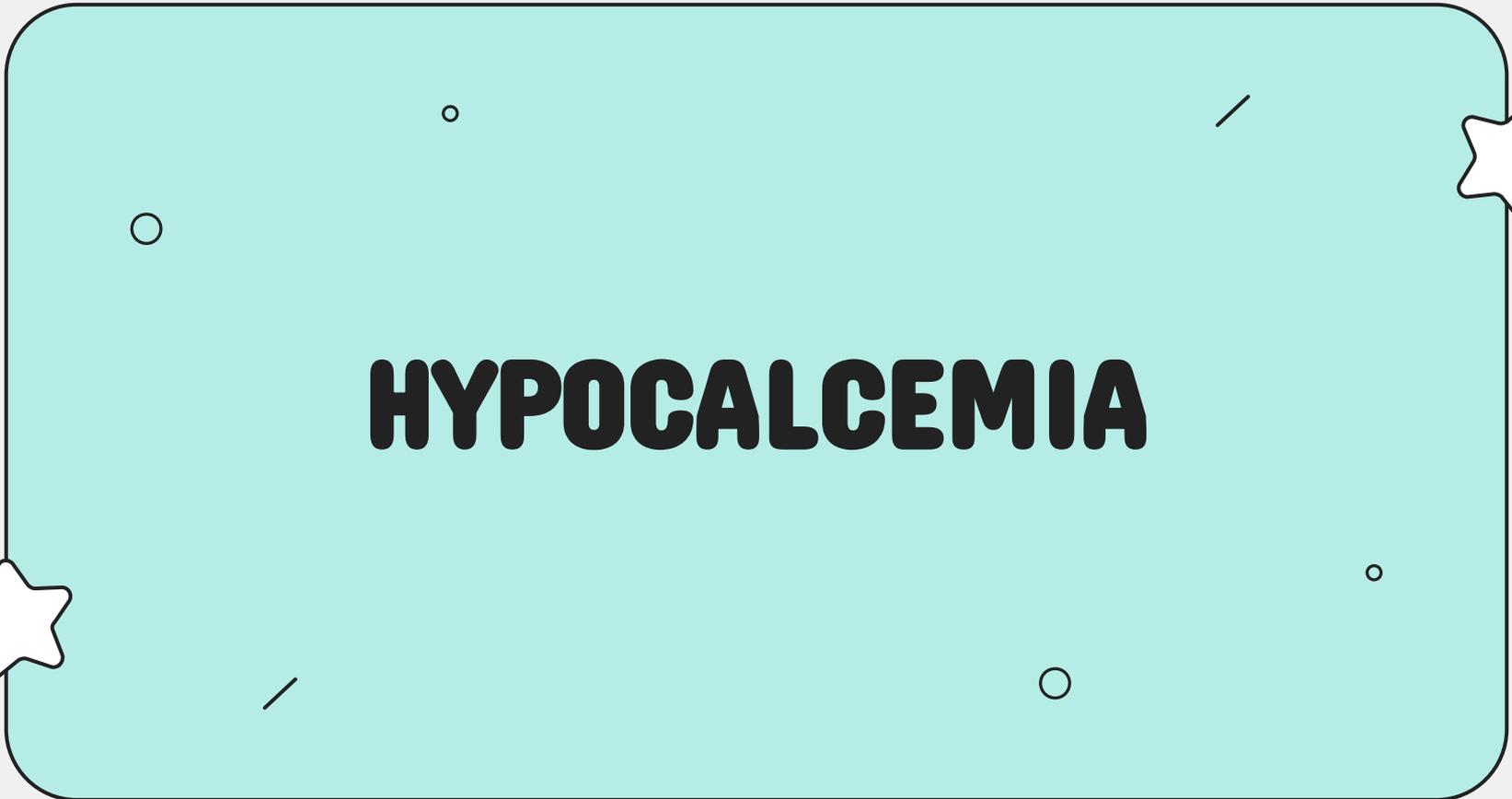
COMPLICATIONS for THYROID SURGERY

- Hypocalcemia and Hypoparathyroidism
- - Nerve Injury
 - Superior Laryngeal Nerve
 - Recurrent Laryngeal Nerve
 - Bleeding

**Table 1** Incidence of post-operative complications or sequelae after thyroid surgery.

	<i>n</i>	Bilateral RLN ^a paralysis	Unilateral RLN ^a paralysis		Hypocalcemia		Compressive hematoma (%)	Sepsis (%)
			Permanent (%)	Transient (%)	Permanent (%)	Transient (%)		
Thomusch et al., 2000 [2]	7266	NS	1.1	2.1	1.5	6.4	2.7	0.6
Bellantone et al., 2002 [3]	204	0	0.2	0.5	2.9	5.8	0.5	0.5
Efremidou et al., 2009 [4]	932	0	1.3	0.2	0.3	7.3	0.2	0.3
Duclos et al., 2012 [5]	3574	0	2.08	—	2.69	20.5	—	—

^a RLN: recurrent laryngeal nerve.



HYPOCALCEMIA

HYPOCALCEMIA

Postoperative Hypoparathyroidism Sequelae

- Common postoperative complication of thyroid surgery
 - *Transient hypocalcemia* (1.2 - 40%): less than 6 months
 - Permanent hypocalcemia (3%): more than 6 months
- Caused by...
 - Parathyroid gland damage (most common)
 - Normal postoperative response to surgical stress including hemodilution and antidiuretic hormone secretion also lowers total serum calcium levels

HYPOCALCEMIA

Definition

- Total serum calcium level that is less than the lower limit of center-specific reference range
 - Total serum calcium level less than 2 mM/L (8.0 mg/dL)

$$\begin{aligned} \text{Corrected calcium (mg/dL)} \\ = \text{Total calcium} + 0.8 (4 - \text{albumin level (gm/dL)}) \end{aligned}$$

Total serum calcium = 50% is in ionized form + 40% is albumin-bound + 10% is complexed to phosphate or citrate

- or Ionized calcium level less than 1.1 mM/L (0.275 mg/dL)

HYPOCALCEMIA

Postoperative Hypoparathyroidism Sequelae

Risk of postoperative hypocalcemia

- Gender: female
- ◦ Young age
- Extreme large goiter
 - e.g. Grave's disease
- Bleeding
- Surgical approach
 - Total thyroidectomy
 - Reoperation
 - Extensive surgery
- Lymph node dissection

HYPOCALCEMIA

Postoperative Hypoparathyroidism Sequelae

Risk of postoperative hypocalcemia

TABLE 1. RISK FACTORS FOR PERMANENT
HYPOPARATHYROIDISM (HYPOPT) FOLLOWING
THYROID-RELATED OPERATIONS

Bilateral (simultaneous or sequential) thyroid procedures
Autoimmune thyroid disease (Graves' disease, chronic lymphocytic thyroiditis)
Central neck dissection—prophylactic or therapeutic
Substernal goiter
Low-volume thyroid surgeon
Prior gastric bypass or other malabsorptive state
Simultaneous thyroidectomy and parathyroidectomy
Prior central neck surgery

HYPOCALCEMIA

Postoperative Hypoparathyroidism Sequelae

Symptoms

- Neurologic symptoms
 - Paresthesias, or numbness and tingling, of perioral region and fingertips (most common early symptoms)
 - more severe neural excitability may lead to Seizures
- Musculoskeletal symptoms
 - Muscle stiffness, cramps, and spasms
 - more sustained muscle contraction may lead to Laryngospasm
- Neuropsychiatric symptoms
 - Confusion, anger, depression, lightheadedness, and irritability

HYPOCALCEMIA

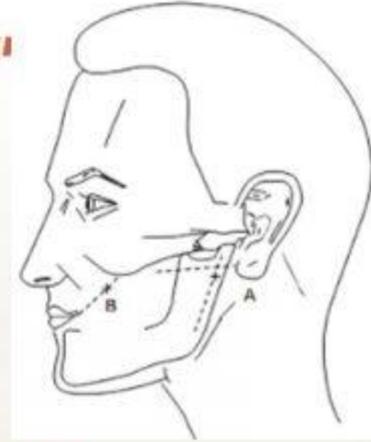
Postoperative Hypoparathyroidism Sequelae

Signs

- Musculoskeletal signs
 - Observed or elicited tetany
 - Classic bedside findings
 - positive Chvostek sign
 - positive Trousseau sign

Chvostek's sign

- Facial muscle twitching upon tapping the preauricular region over the facial nerve
- Present at baseline in up to 25% of people
- Tap area 0.5 to 1 cm below the zygomatic process of the temporal bone, 2 cm anterior to the ear lobe, and on a line with the angle of the mandible
- Other conditions include rickets, diphtheria, measles, scarlet fever and myxedema.

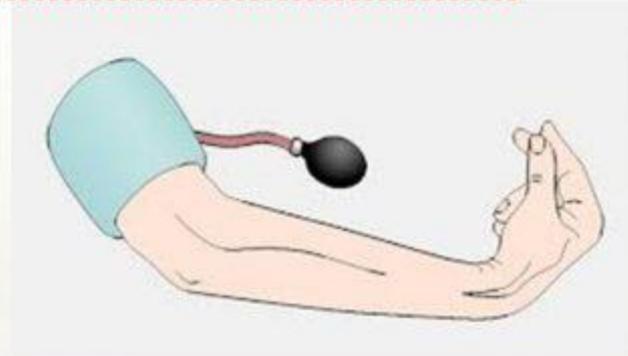


Grading:

1. Twitching of lip at angle of mouth
2. Twitching of alar nasi
3. Twitching of lateral angle of eye
4. Twitching of all facial muscles

Trousseau's sign

- ✿ Flexion of the wrist, thumb, and metacarpophalangeal joints and hyperextension of the fingers
- ✿ Brachial artery occlusion by inflation of a blood pressure cuff above systolic blood pressure
- ✿ More sensitive (94%) than the Chvostek's sign (29%) for hypocalcemia
- ✿ Other positive sign is hypomagnesemia



Methods:

- Inflated pressure cuff to a pressure greater than SBP 20 mmHg for 3 minutes to occlude the brachial artery
- Subsequent neuromuscular irritability will induce spasm

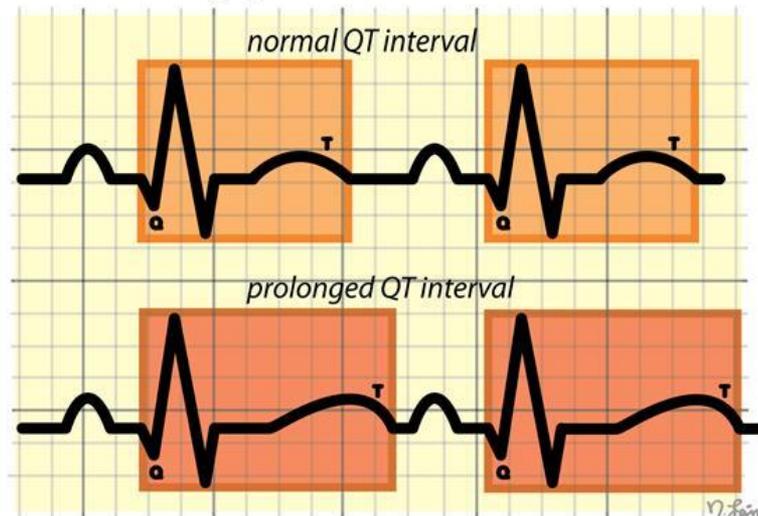
HYPOCALCEMIA

Postoperative Hypoparathyroidism Sequelae

Signs

- Cardiovascular signs
 - with progressive hypocalcemia
 - Prolongation of the QT interval
 - Torsades de pointes
 - Ventricular fibrillation

Hypocalcemia



Postoperative thyroid hypocalcemia diagnosis and management protocol

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Figure 1. Management in the preoperative phase

Preoperative phase: Detection of risk patients

- Uncontrolled hyperthyroidism/Graves' surgery
- Expected lymph node resection
- Simultaneous thyroid/parathyroid surgery
- Previous cervical surgery (consult the intervention sheet and the pathological anatomy in search of excised, biopsied, or implanted glands)
- Malabsorption (determine magnesium)
- Modified cervical anatomy (surgery, tumor inflammation)



Treat vitamin D deficiency

Strict follow-up in the postoperative period

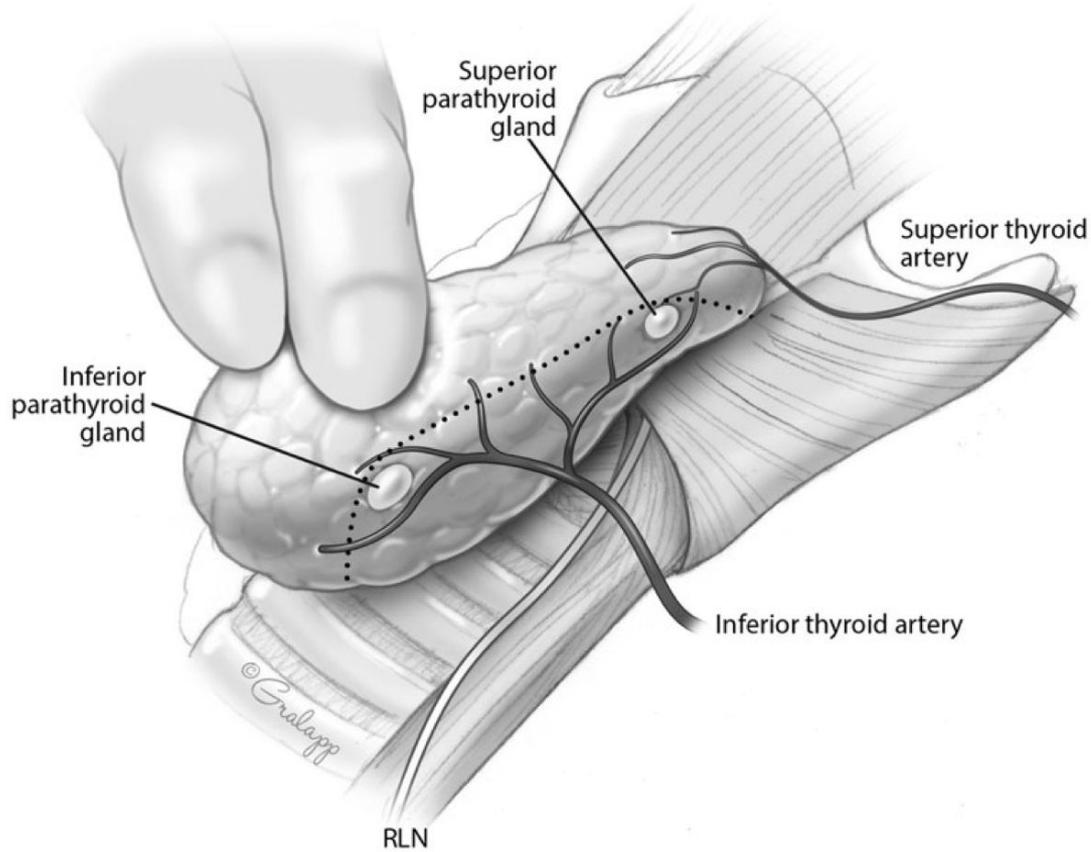


FIG. 1. Plane of capsular dissection (dotted line) during thyroidectomy, dividing vasculature medial (distal) to the parathyroid glands in order to allow preservation of the parathyroid blood supply.

POSTOPERATIVE MANAGEMENT of **HYPOCALCEMIA**

- Determining PTH levels and their percentage decrease with respect to preoperative values to detect those patients with highest risk of hypocalcemia in the first 24 h after thyroidectomy
 - No recommendation of specific cut-off point for PTH
- Serial determination of ionic calcium or corrected total calcium to identify those patients with the highest risk of hypocalcemia, candidates for treatment with calcium and/or calcitriol supplements

POSTOPERATIVE MANAGEMENT of HYPOCALCEMIA

- Determination of plasma phosphorus to identify and detect patients with possible hungry bone
 - Clinical manifestations of HBS is severe hypocalcemia after
 - post-op parathyroidectomy
- Taking the Trousseau sign in turns

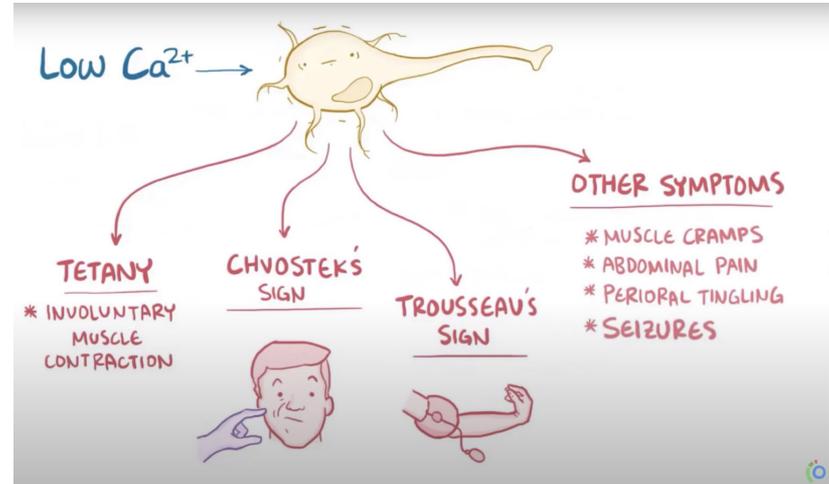
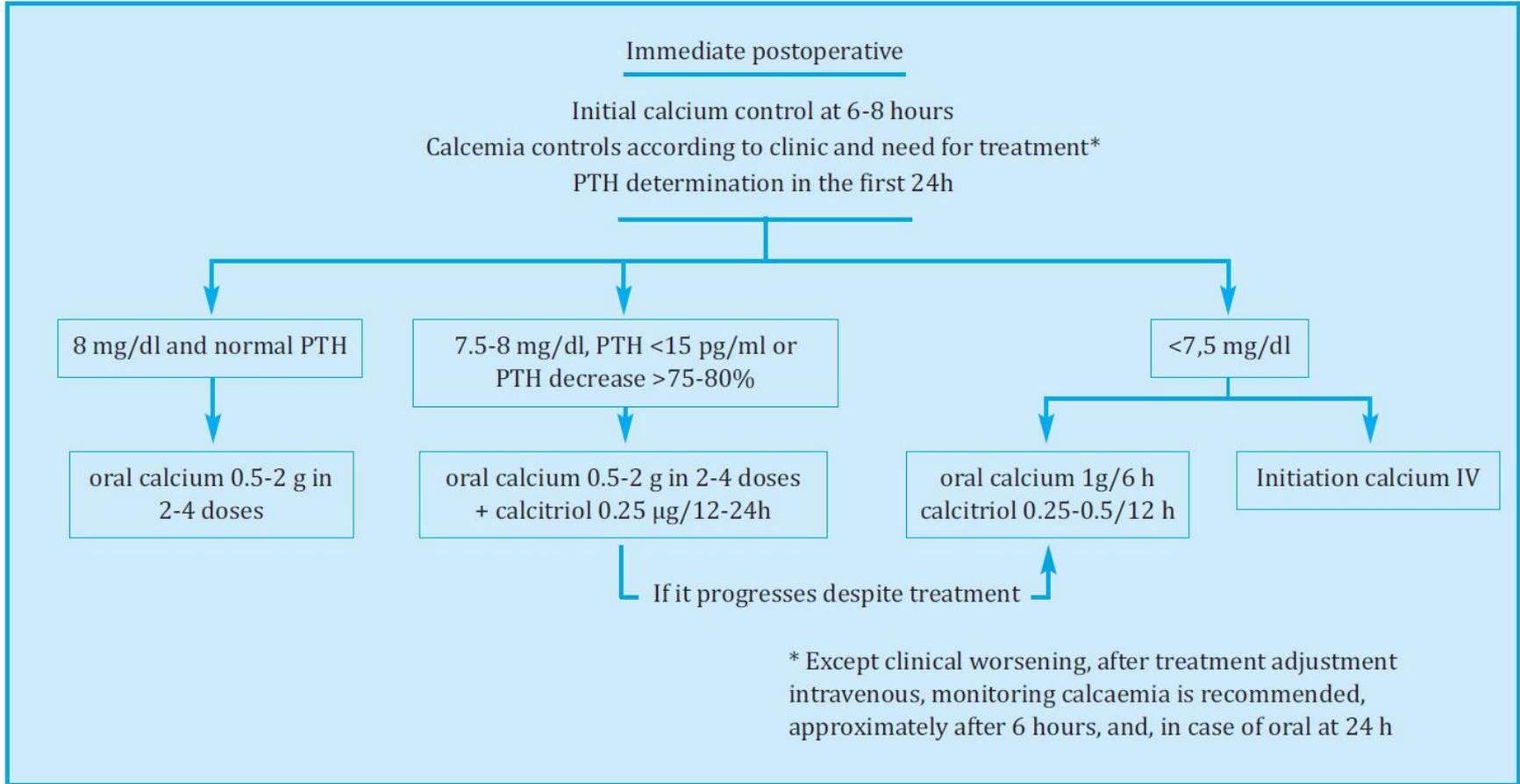


Figure 2. Immediate postoperative management



POSTOPERATIVE MANAGEMENT of **HYPOCALCEMIA**

Severe hypocalcemia

- Presents with symptoms of carpopedal spasm, tetany, seizures or lengthening of the QT interval
- Level <7.5 mg/dl, even if asymptomatic

POSTOPERATIVE MANAGEMENT of HYPOCALCEMIA

Severe hypocalcemia

● Treatment

- ○ IV Bolus of 1 or 2 g of calcium gluconate (GC) in 50 ml of 5% glucose serum or saline infused in 10-20 minutes
 - Raises calcium level for about 2 - 3 hours
- Followed by slow infusion of calcium in patients with persistent hypocalcemia (about 50 mg of element calcium per hour)
GC 11 g (11 ampoules of 10% GC) + 93 mg of element calcium per ampoule = 1,000 mg of element calcium in 1,000 ml of 5% glucose serum or saline, to be administered at 50 ml/hour
 - Require 0.5 - 1.5 mg of calcium element/kg/hr
- Infusion must not contain bicarbonate or phosphate, as they can form insoluble calcium salts

POSTOPERATIVE MANAGEMENT of **HYPOCALCEMIA**

Side effect of intravenous administration of calcium salts

- Vasodilation
- Decreased blood pressure
- Bradycardia
- Cardiac arrhythmias
- Syncope
- Cardiac arrest
- Tissue necrosis; if calcium chloride is extravasation

HEMATOMA





**DREADED POST-OPERATIVE COMPLICATION
AFTER THYROID SURGERY
for ANESTHESIOLOGIST is
AIRWAY OBSTRUCTION**

due to...

- Large hematoma causing direct compression of airway
- Laryngeal edema due to venous obstruction caused by hematoma
- Bilateral recurrent laryngeal nerve damage
- Tracheomalacia

ID ABS WEB: 92499

POST-THYROIDECTOMY HAEMATOMA: RELEASE THE SUTURES AND INTUBATE OR VICEVERSA? A CASE REPORT

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Introduction: Neck haematomas are rare but life-threatening complications of thyroid surgery. If not timely recognised, they can rapidly lead to upper airway compression and obstruction. We present a case of post-thyroidectomy haematoma. The case was presented to Court to rule out any medical malpractice.

Case: A 72-year-old female patient underwent a successful left hemithyroidectomy. Early postoperative period was characterized by two episodes of discomfort and dyspnea, treated with cortison and bronchodilators with fast recovery. On postoperative day 1, the patient was awake and responsive, complaining breathing difficulty with normal vital parameters. The neck was swollen. The anaesthetist called the surgeon and went to prepare for urgent intubation; five minutes later, the patient was in cardiorespiratory arrest. ALS was started, two laryngoscopic attempts at bedside failed. Difficult, though satisfactory, mask ventilation was therefore performed until the surgeon released the neck sutures and tried an emergency cricothyroidotomy, but by that time the patient had died.

Discussion: The court consultant disagreed with the anaesthetist's conduct, arguing he should have attempted intubation during his first assessment of the patient. Analyzing available literature it seems safer to first release the sutures and rapidly decompress the haematoma and then, once airway compression is resolved, attempt intubation for a more likely successful result^{1,2}. At this point, if the respiratory failure is not reversed and laryngoscopy fails, an "open" cricothyroidotomy might be performed. On the other hand, some authors claim that immediate intubation should be performed in the case of respiratory distress from airway obstruction³.

Learning Points: References

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3. Lee HS, Lee BJ. Patterns of post-thyroidectomy hemorrhage. *Clin Exp Otorhinolaryngol* 2009;2:72-7

Guidelines

Management of haematoma after thyroid surgery: systematic review and multidisciplinary consensus guidelines from the Difficult Airway Society, the British Association of Endocrine and Thyroid Surgeons and the British Association of Otorhinolaryngology, Head and Neck Surgery

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Postoperative haemorrhage

is a well-recognised complication of thyroid surgery
with an incidence between



0.45%-4.2%

○

○ AIM to PRODUCE GUIDELINE

to support members of multidisciplinary team in management of postoperative haematoma following anterior cervical approach thyroidectomy by *providing clear recommendations to enable organisational preparedness, early recognition and prompt clinical management*

○

may apply to other types of neck surgery, such as parathyroid, cervical spine or vascular surgery, and offer a basis to support future work in this area.

MULTIDISCIPLINARY TEAM CONSENSUS GUIDELINE



Difficult Airway Society (DAS)



**British Association of Endocrine and
Thyroid Surgeons (BAETS)**



**British Association of Otorhinolaryngology,
Head and Neck Surgery (ENT-UK)**

Table 2 Grading of recommendations based on the level of evidence available.

Grade	Level of evidence available
A	<ul style="list-style-type: none">• Consistent systematic reviews of RCTs, single RCTs or all-or-none studies
B	<ul style="list-style-type: none">• Consistent systematic reviews of low-quality RCTs or cohort studies, individual cohort study, or epidemiological outcome studies• Consistent systematic reviews of case–control studies, individual case–control studies• Extrapolations from systematic reviews of RCTs, single RCTs or all-or-none studies
C	<ul style="list-style-type: none">• Case series, case reports• Extrapolations from systematic reviews of low-quality RCTs, cohort studies or case–control studies, individual cohort study, epidemiological outcome studies, individual case–control studies• Extrapolations from systematic reviews of case–control studies
D	<ul style="list-style-type: none">• Expert opinion or ideas based on theory, bench studies or first principles alone• Troublingly inconsistent or inconclusive studies of any level

RCT, randomised controlled trial.

Monitoring

Haemorrhage and subsequent haematoma...

- Most frequently occur within the first 24 h following thyroid surgery
- ◦ Approximately half occurring within 6 h
- Several cases of haematoma following thyroid surgery have been reported after 24 h is extremely rare
 - Several factors have been associated with an increased risk of haematoma but unpredictable
 - Increasing age
 - Male sex ◦

Monitoring

- Following initial 6-h period (suggestion)
 - Frequency of observations may be tailored according to individual patient risk and local policies
- Optimal patient visibility to nursing staff wherever possible
 - in Open ward or Bed located near to the nursing station
 - Open wards and multi-bedded areas may also allow others on ward to alert nursing staff in event of acute deterioration

Monitoring

Minimum monitoring

- Wound inspection
- Early warning score
 - Respiratory rate
 - Heart rate
 - Blood pressure
 - Temperature
 - Arterial oxygen saturations
 - Glasgow Coma Scale
- Pain score
- Awareness
- Subtle signs
 - Agitation
 - Anxiety
 - Difficulty in breathing
 - Discomfort

Monitoring



Post-thyroid surgery regular review

This patient requires **close postoperative observation**. This tool aims to highlight signs that require an urgent senior clinical review. As well as standard **NEWS** observations, aim to:

Closely monitor for **DESATS**

- D** - Difficulty swallowing/discomfort
- E** - EWS/NEWS
- S** - Swelling
- A** - Anxiety
- T** - Tachypnoea/difficulty breathing
- S** - Stridor

*This **DESATS** acronym is to help pick up early signs which need urgent senior clinical review. We stress that desaturation and increasing oxygen requirements are a late sign of airway compromise. Act early to avoid subsequent deterioration.*

If your review reveals any one or more of the above:

1. **OXYGENATE**: Give 15 l.min⁻¹ O₂
2. Nurse at 45° head-up
3. See management of suspected haematoma following thyroid surgery guideline: **EVALUATE**
4. **Arrange for immediate senior surgical review** (registrar or consultant) – if not immediately available senior anaesthetic review should be arranged.
5. **If there are any signs of airway compromise EVACUATE** haematoma and request immediate senior anaesthetic review.

Recognition

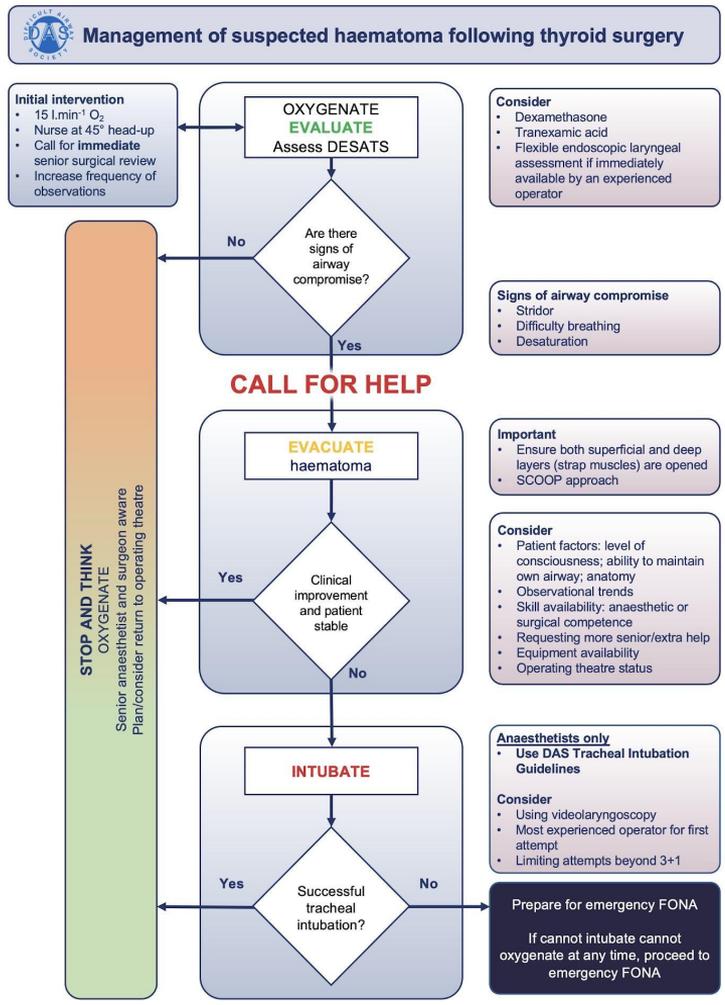


Table 1 Recommended contents of post-thyroid surgery emergency box.

Should include

Artery clip

Management of suspected haematoma following thyroid surgery guideline

SCOOP guideline

Scalpel

Scissors

Sterile gauze or medium wound pack

Could also include

Gloves

Staple remover (if staples used)

SCOOP; skin exposure, cut sutures, open skin, open muscles, pack wound.

○ **Management of**
Suspected Haematoma
following
Thyroid Surgery ○



Oxygenate and Evaluate



Management of suspected haematoma following thyroid surgery

Initial intervention

- 15 l.min⁻¹ O₂
- Nurse at 45° head-up
- Call for **immediate** senior surgical review
- Increase frequency of observations

OXYGENATE
EVALUATE
Assess DESATS

No
Are there signs of airway compromise?

Yes

CALL FOR HELP

Consider

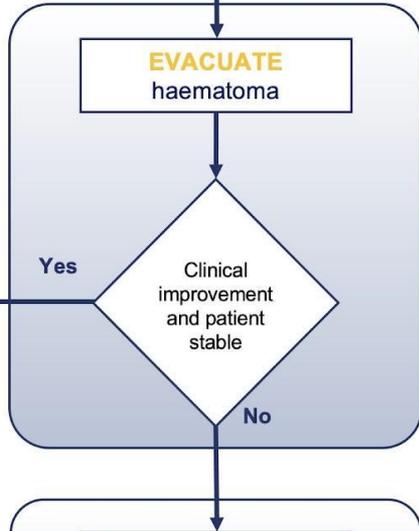
- Dexamethasone
- Tranexamic acid
- Flexible endoscopic laryngeal assessment if immediately available by an experienced operator

Signs of airway compromise

- Stridor
- Difficulty breathing
- Desaturation

Evacuate

CALL FOR HELP



Important

- Ensure both superficial and deep layers (strap muscles) are opened
- SCOOP approach

Consider

- Patient factors: level of consciousness; ability to maintain own airway; anatomy
- Observational trends
- Skill availability: anaesthetic or surgical competence
- Requesting more senior/extra help
- Equipment availability
- Operating theatre status

Anaesthetists only

Management of suspected haematoma following thyroid surgery

Initial intervention

- 15 l.min⁻¹ O₂
- Nurse at 45° head-up
- Call for immediate senior surgical review
- Increase frequency of observations

OXYGENATE EVALUATE Assess DESATS

Are there signs of airway compromise?

No

CALL FOR HELP

EVACUATE haematoma

Yes

Clinical improvement and patient stable

No

INTUBATE

Yes

Successful tracheal intubation?

No

Consider

- Dexamethasone
- Tranexamic acid
- Flexible endoscopic laryngeal assessment if immediately available by an experienced operator

Signs of airway compromise

- Stridor
- Difficulty breathing
- Desaturation

Important

- Ensure both superficial and deep layers (strap muscles) are opened
- SCOOP approach

Consider

- Patient factors: level of consciousness; ability to maintain own airway; anatomy
- Observational trends
- Skill availability: anaesthetic or surgical competence
- Requesting more senior/extra help
- Equipment availability
- Operating theatre status

Anaesthetists only

- Use DAS Tracheal Intubation Guidelines

Consider

- Using videolaryngoscopy
- Most experienced operator for first attempt
- Limiting attempts beyond 3+1

Prepare for emergency FONA

If cannot intubate cannot oxygenate at any time, proceed to emergency FONA

STOP AND THINK
OXYGENATE
Senior anaesthetist and surgeon aware
Plan/consider return to operating theatre

Management of acute haematoma following thyroid surgery: **EVACUATE**

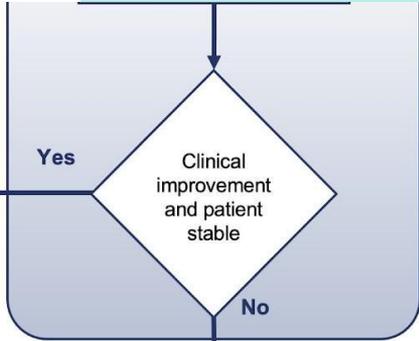
*Signs of airway compromise:
Stridor; difficulty breathing; desaturation

WRITE CONTACT
NUMBERS HERE

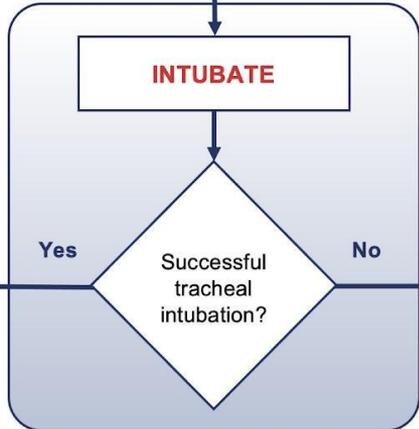
S SKIN EXPOSURE	 1 CONTACT CRASH TEAM + DUTY SURGEON	 2 SKIN EXPOSURE
	 3 CUT SUBCUTICULAR SUTURES	 4 PUSH FINGERS INTO WOUND
	 5 OPEN SKIN TO EXPOSE STRAP MUSCLES	 6 OPEN STRAP MUSCLES TO EXPOSE TRACHEA
	 7 PACK WOUND	 8 COVER WOUND WITH A PACK

Intubate

STOP AND THINK
OXYGENATE
Senior anaesthetist and surgeon aware
Plan/consider return to operating theatre



- SCOP approach**
- Consider**
- Patient factors: level of consciousness; ability to maintain own airway; anatomy
 - Observational trends
 - Skill availability: anaesthetic or surgical competence
 - Requesting more senior/extra help
 - Equipment availability
 - Operating theatre status



- Anaesthetists only**
- Use DAS Tracheal Intubation Guidelines
- Consider**
- Using videolaryngoscopy
 - Most experienced operator for first attempt
 - Limiting attempts beyond 3+1

Prepare for emergency FONA

If cannot intubate cannot oxygenate at any time, proceed to emergency FONA

Management of suspected haematoma following thyroid surgery

Initial intervention

- 15 l.min⁻¹ O₂
- Nurse at 45° head-up
- Call for immediate senior surgical review
- Increase frequency of observations

OXYGENATE EVALUATE Assess DESATS

Are there signs of airway compromise?

Consider

- Dexamethasone
- Tranexamic acid
- Flexible endoscopic laryngeal assessment if immediately available by an experienced operator

Signs of airway compromise

- Stridor
- Difficulty breathing
- Desaturation

CALL FOR HELP

EVACUATE haematoma

Clinical improvement and patient stable?

Important

- Ensure both superficial and deep layers (strap muscles) are opened
- SCOP approach

Consider

- Patient factors: level of consciousness; ability to maintain own airway; anatomy
- Observational trends
- Skill availability: anaesthetic or surgical competence
- Requesting more senior/extra help
- Equipment availability
- Operating theatre status

INTUBATE

Successful tracheal intubation?

Anaesthetists only

- Use DAS Tracheal Intubation Guidelines

Consider

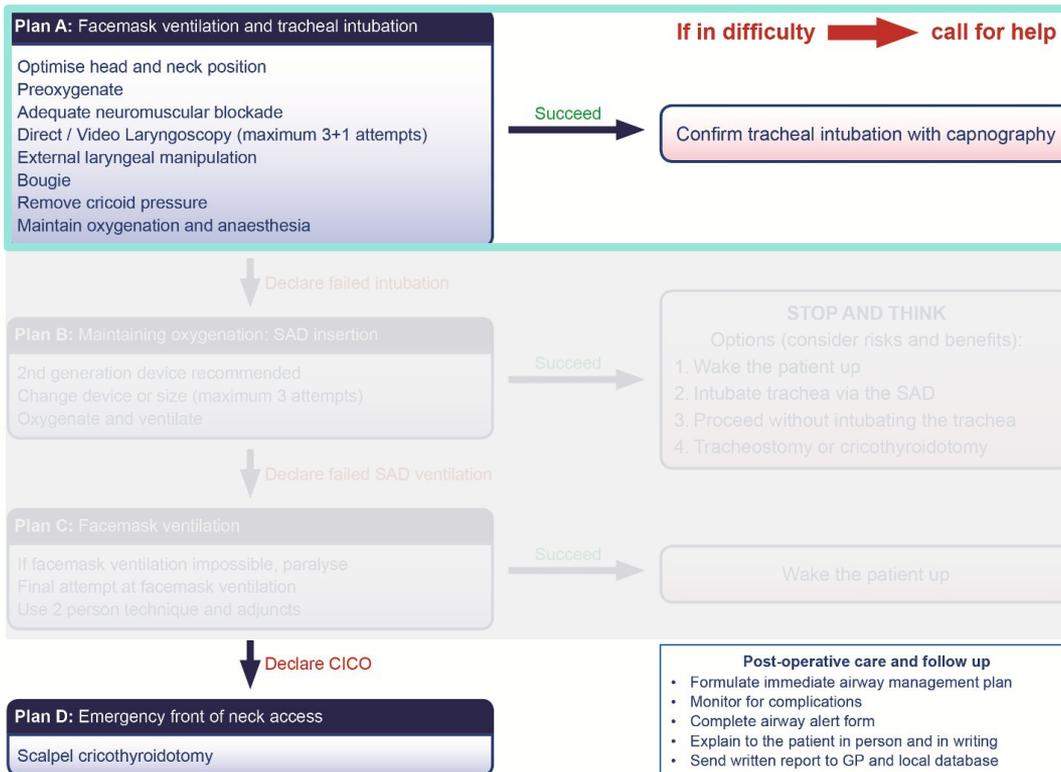
- Using videolaryngoscopy
- Most experienced operator for first attempt
- Limiting attempts beyond 3+1

Prepare for emergency FONA

If cannot intubate cannot oxygenate at any time, proceed to emergency FONA

STOP AND THINK
OXYGENATE
Senior anaesthetist and surgeon aware
Plan/consider return to operating theatre

Management of unanticipated difficult tracheal intubation in adults



This flowchart forms part of the DAS Guidelines for unanticipated difficult intubation in adults 2015 and should be used in conjunction with the text.

OXYGENATE

- Apply HFNO early
- Titrate HFNO from 30–70 L.min⁻¹
- Continue HFNO throughout procedure

TOPICALISE

- Lidocaine 10% spray to oropharynx, tonsillar pillars, base of tongue
- 20 – 30 sprays (during inspiration, over 5 min)
- If nasal route: co-phenylcaine spray
- Test topicalisation atraumatically
- If inadequate, re-apply LA up to maximum dose:
 - Further 5 sprays of lidocaine 10% to tongue base
 - 2 ml lidocaine 2% (x 3) spray above, at and below vocal cords via epidural catheter/working channel of FB or using MAD

Lidocaine

- 1 spray (0.1 ml) of 10% = 10 mg
- 1 ml of 2% = 20 mg

Co-phenylcaine

- 2.5 ml = 125 mg lidocaine + 12.5 mg phenylephrine

PERFORM

- Select appropriate tracheal tube
- Patient sitting up
- Ensure operator can readily see patient monitor, infusion pumps and video screen
- Clear secretions
- For ATI:FB
 - Operator positioned facing patient
 - Consider bronchoscope airway if oral route
 - Bevel facing posteriorly
- For ATI:VL
 - Operator positioned behind patient
 - Consider bougie
- Before induction of anaesthesia: two-point check

SEDATE

- Sedate if required
- Remifentanyl TCI (Minto) Ce 1.0–3.0 ng.ml⁻¹
- If second anaesthetist present, consider adding midazolam 0.5–1 mg

Figure 2 The Difficult Airway Society awake tracheal intubation (ATI) technique. This figure forms part of the Difficult Airway Society guidelines for ATI in adults and should be used in conjunction with the text. HFNO, high-flow nasal oxygen; LA, local anaesthetic; FB, flexible bronchoscopy; MAD, mucosal atomising device; TCI, target-controlled infusion; Ce, effect-site concentration; VL, videolaryngoscopy. ©Difficult Airway Society 2019.

Table 3 Characteristics of drugs used commonly during ATI.

Class	Drug	Onset	Duration of action	Terminal elimination half-life	Dosing	Notes
Antisialagogue	Glycopyrronium bromide	20 min (i.m.)	30–60 min	40–80 min	0.2–0.4 mg	Administer 30–60 min pre-procedure
		3–5 min (i.v.)	30–60 min	40–80 min	0.1–0.2 mg	May produce significant tachycardia
	Atropine	20 min (i.m.)	30–60 min	2 h	0.3–0.6 mg	Administer 30–60 min pre-procedure – less commonly used than glycopyrronium bromide due to tachycardia
		2–3 min (i.v.)	30–60 min	2 h	0.2–0.3 mg	May produce significant tachycardia
Hyoscine hydrobromide	30 min (i.m.)	4 h	5 h	0.2–0.6 mg	Administer 30–60 min pre-procedure	
	5–10 min (i.v.)				Longer lasting systemic effects than glycopyrronium bromide and atropine May produce tachycardia, dizziness and sedation	
Topical anaesthesia	Co-phenylcaine spray	2–5 min	30 min	1.5–2 h	Lidocaine 125 mg Phenylephrine 12.5 mg	1 bottle = 2.5 ml of lidocaine 50 mg.ml ⁻¹ and phenylephrine 5 mg.ml ⁻¹
	Lidocaine 1–10%	5 min	30–60 min	1.5–2 h	Total dose not > 9 mg.kg ⁻¹ LBW	1 ml of 1% = 10 mg 1 spray of 10% = 10 mg
	Cocaine 10%	1–3 min	30–60 min	1 h	< 1.5 mg.kg ⁻¹	LD50 1.2 g, but significant toxic effects have been reported at doses as low as 20 mg in adults Particular care in older patients and/or those with cardiac disease

Table 3 Characteristics of drugs used commonly during ATI.

Class	Drug	Onset	Duration of action	Terminal elimination half-life	Dosing	Notes
Sedatives	Propofol	30 s	5–10 min	1.5–3 h	TCI (effect-site) 0.5–1 $\mu\text{g}\cdot\text{ml}^{-1}$	Caution with doses in excess of 1.5 $\mu\text{g}\cdot\text{ml}^{-1}$: risk of over-sedation and hypoventilation, particularly with concomitant opioid use Avoid bolus dosing
	Midazolam	3–5 min	1–2 h	1.5–3 h	Bolus 0.5–1 mg	Titrate to effect Peak effect at 5–10 min so care with multiple doses
	Dexmedetomidine	1–2 min	5–10 min	2 h	Bolus 0.5–1 $\mu\text{g}\cdot\text{kg}^{-1}$ over 5 min followed by infusion (0.3–0.6 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$)	Caution with bolus dosing as associated with hypertension and bradycardia
Analgesia	Remifentanyl	1 min	3–5 min	1–20 min	TCI (effect-site) 1–3 $\text{ng}\cdot\text{ml}^{-1}$	Caution with respiratory depression. Avoid bolus dosing.
	Fentanyl	2–5 min	30–60 min	6–10 min	Bolus 0.5–1 $\mu\text{g}\cdot\text{kg}^{-1}$, subsequent doses of 0.5 $\mu\text{g}\cdot\text{kg}^{-1}$ as required	
	Alfentanil	2–3 min	15 min	90–120 min	Bolus 5 $\mu\text{g}\cdot\text{kg}^{-1}$, subsequent doses of 1–3 $\mu\text{g}\cdot\text{kg}^{-1}$ as required	

ATI, awake tracheal intubation; i.m., intramuscular; i.v., intravenous; TCI, target-controlled infusion; LD50, median lethal dose; LBW, lean body weight.

Table 4 Special circumstances that may affect standard performance of ATI with suggested management options.

Special circumstance	Considerations	Modification	Potential management options
Stridor	Critical adverse consequences of over-sedation Risk of laryngospasm	Sedation Topicalisation	Avoid or minimise sedation Consider nebulised and/or lower concentrations of lidocaine
	Airway obstruction Narrowed airway	Oxygenation Performance	HFNO highly recommended Recognise that airway narrowing may preclude oral or nasal tracheal intubation Prime for emergency FONA Use smaller tracheal tube Most experienced practitioner to perform May require combined technique

ATI, awake tracheal intubation; VL, videolaryngoscopy; SAD, supraglottic airway device; HFNO, high-flow nasal oxygen; FB, flexible bronchoscopy; FONA, front-of-neck airway.

Management of unanticipated difficult tracheal intubation in adults

Plan A: Facemask ventilation and tracheal intubation

Optimise head and neck position
 Preoxygenate
 Adequate neuromuscular blockade
 Direct / Video Laryngoscopy (maximum 3+1 attempts)
 External laryngeal manipulation
 Bougie
 Remove cricoid pressure
 Maintain oxygenation and anaesthesia

If in difficulty → call for help

Succeed →

Confirm tracheal intubation with capnography

↓ Declare failed intubation

Plan B: Maintaining oxygenation: SAD insertion

2nd generation device recommended
 Change device or size (maximum 3 attempts)
 Oxygenate and ventilate

Succeed →

STOP AND THINK

Options (consider risks and benefits):

1. Wake the patient up
2. Intubate trachea via the SAD
3. Proceed without intubating the trachea
4. Tracheostomy or cricothyroidotomy

↓ Declare failed SAD ventilation

Plan C: Facemask ventilation

If facemask ventilation impossible, paralyse
 Final attempt at facemask ventilation
 Use 2 person technique and adjuncts

Succeed →

Wake the patient up

↓ Declare CICO

Plan D: Emergency front of neck access

Scalpel cricothyroidotomy

Post-operative care and follow up

- Formulate immediate airway management plan
- Monitor for complications
- Complete airway alert form
- Explain to the patient in person and in writing
- Send written report to GP and local database

This flowchart forms part of the DAS Guidelines for unanticipated difficult intubation in adults 2015 and should be used in conjunction with the text.

Failed intubation, failed oxygenation in the paralysed, anaesthetised patient

CALL FOR HELP



Continue 100% O₂
Declare CICO

Plan D: Emergency front of neck access

Continue to give oxygen via upper airway
Ensure neuromuscular blockade
Position patient to extend neck

Scalpel cricothyroidotomy

Equipment: 1. Scalpel (number 10 blade)
2. Bougie
3. Tube (cuffed 6.0mm ID)

Laryngeal handshake to identify cricothyroid membrane

Palpable cricothyroid membrane

Transverse stab incision through cricothyroid membrane
Turn blade through 90° (sharp edge caudally)
Slide coude tip of bougie along blade into trachea
Railroad lubricated 6.0mm cuffed tracheal tube into trachea
Ventilate, inflate cuff and confirm position with capnography
Secure tube

Impalpable cricothyroid membrane

Make an 8-10cm vertical skin incision, caudad to cephalad
Use blunt dissection with fingers of both hands to separate tissues
Identify and stabilise the larynx
Proceed with technique for palpable cricothyroid membrane as above

Post-operative care and follow up

- Postpone surgery unless immediately life threatening
- Urgent surgical review of cricothyroidotomy site
- Document and follow up as in main flow chart

Cricothyrotomy

Indications

Inability to maintain >90% saturation between intubation attempts or after three attempts
Inability to bag-mask-valve ventilate the patient between intubation attempts or after three attempts
Multiple attempts at endotracheal intubation fail to secure the airway after failed rescue maneuvers (e.g., gum elastic bougie intubation, intubating laryngeal mask airway)

Contraindications

Age younger than 5–12 years (depending on the source)
Tracheal transection, fracture, or obstruction below the cricothyroid membrane

Complications

Acute

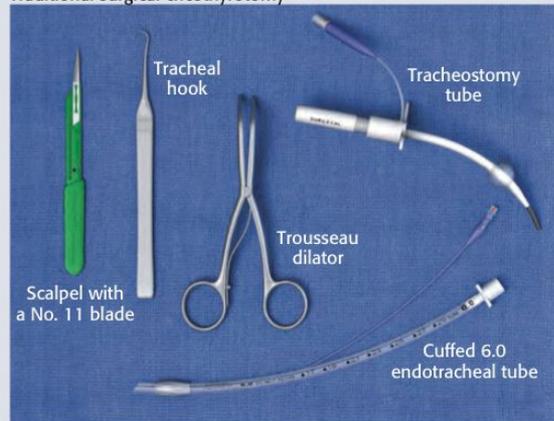
- Bleeding
- Tube malposition
- Bronchial intubation
- Laryngotracheal injury
- Tension pneumothorax
- Tube obstruction

Late

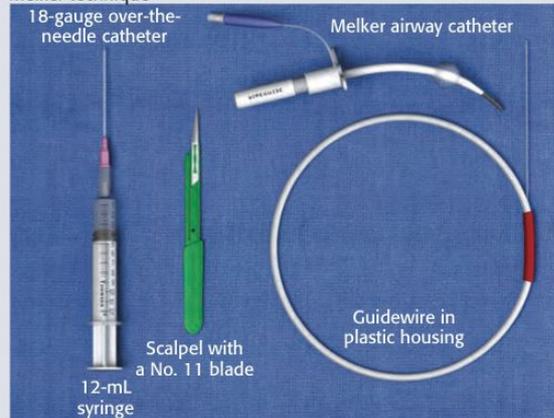
- Subjective voice changes
- Difficulty swallowing
- Infections
- Persistent shortness of breath
- Persistent stoma
- Subglottic or glottic stenosis

Equipment

Traditional surgical cricothyrotomy



Melker technique



SURGICAL CRICOTHYROTOMY: TRADITIONAL TECHNIQUE

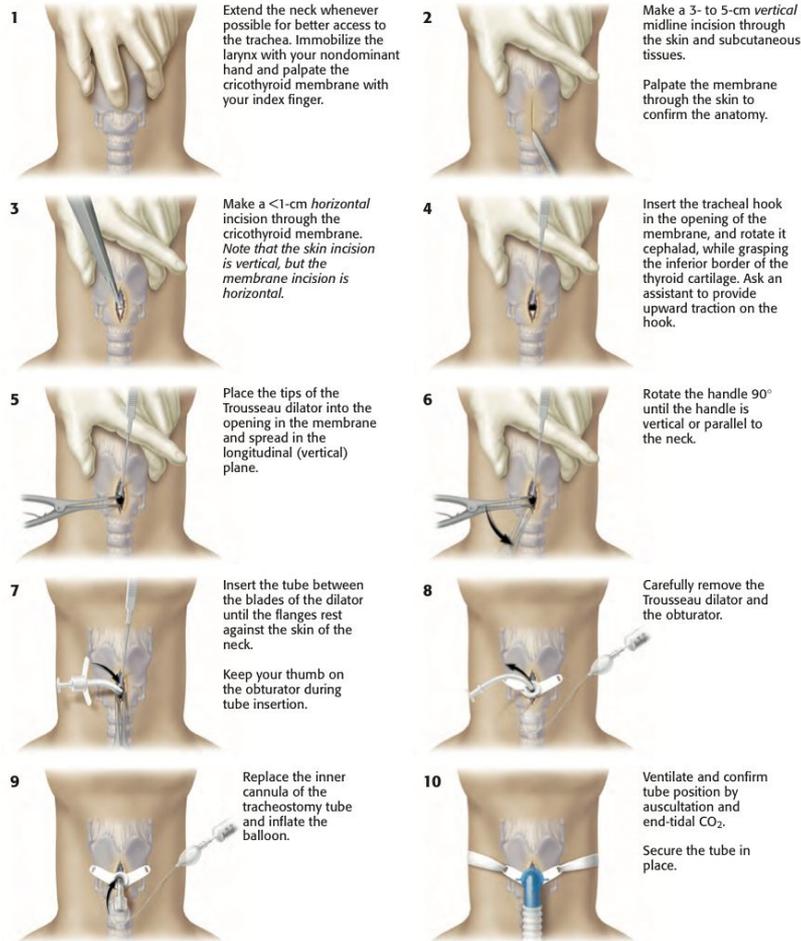


Figure 6.6 Surgical cricothyrotomy: traditional technique. (Adapted from Custalow CB: *Color atlas of emergency department procedures*, Philadelphia, 2005, Saunders.)

SURGICAL CRICOTHYROTOMY: RAPID FOUR-STEP TECHNIQUE

1



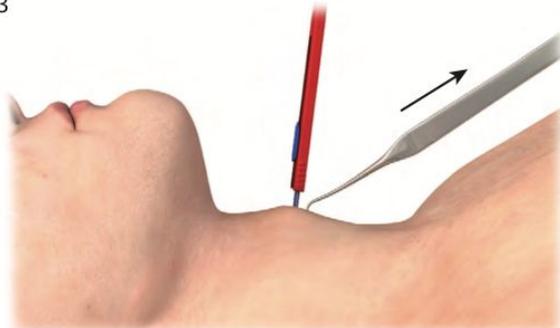
If possible, extend the neck to better expose the trachea. Palpate the depression over the cricothyroid membrane with your nondominant hand.

2



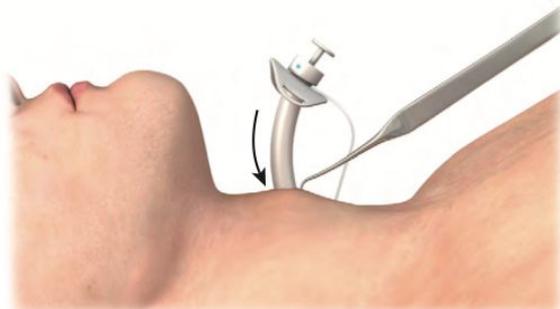
Make a 1.5-cm single horizontal stab incision through the skin, subcutaneous tissue, and cricothyroid membrane.

3



Using the scalpel blade as a guide, pick up the cricoid cartilage with the tracheal hook and provide traction in the caudal direction to stabilize the trachea.

4



Place a No. 4 cuffed tracheostomy tube or a 6.0 cuffed endotracheal tube through the opening.

Figure 6.9 Surgical cricothyrotomy: rapid four-step technique. Extension of the neck (if clinically feasible) facilitates the procedure. (Redrawn from Brofeldt BT, Panacek EA, Richards JR: An easy cricothyrotomy approach: the Rapid Four Step Technique. *Acad Emerg Med* 3:1060, 1996).

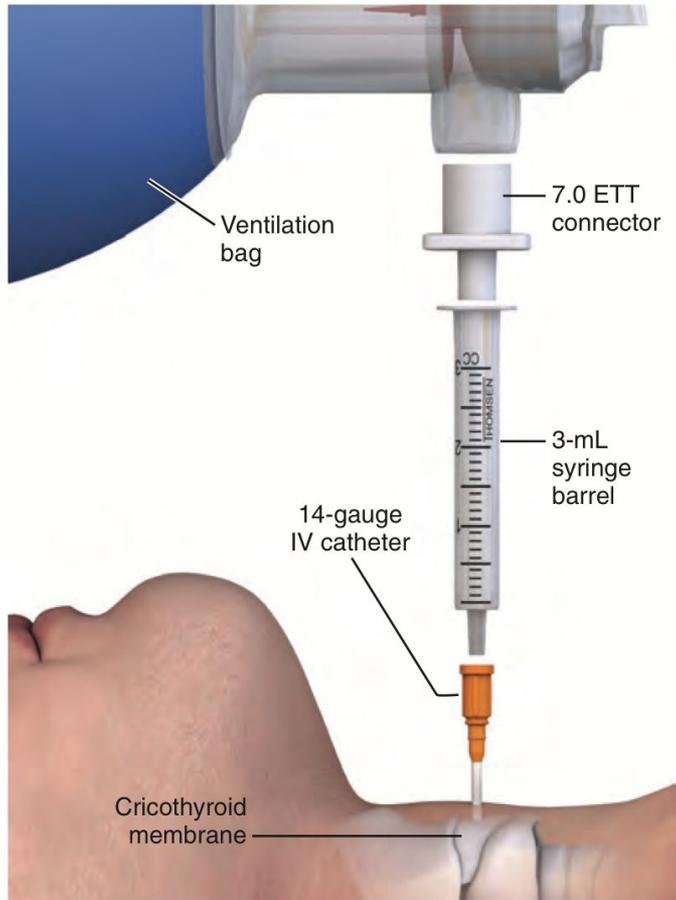


Figure 6.13 Homemade ventilation setup for transtracheal catheter ventilation using a ventilation bag, a standard endotracheal tube adapter, a 3-mL syringe, and a 14-gauge angiocatheter. *ETT*, Endotracheal tube; *IV*, intravenous.

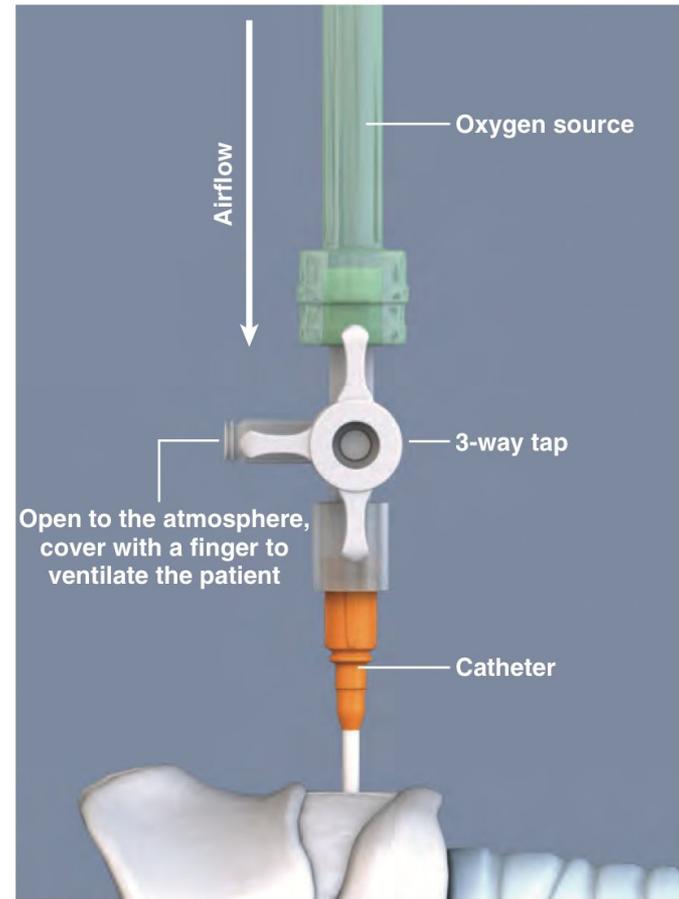
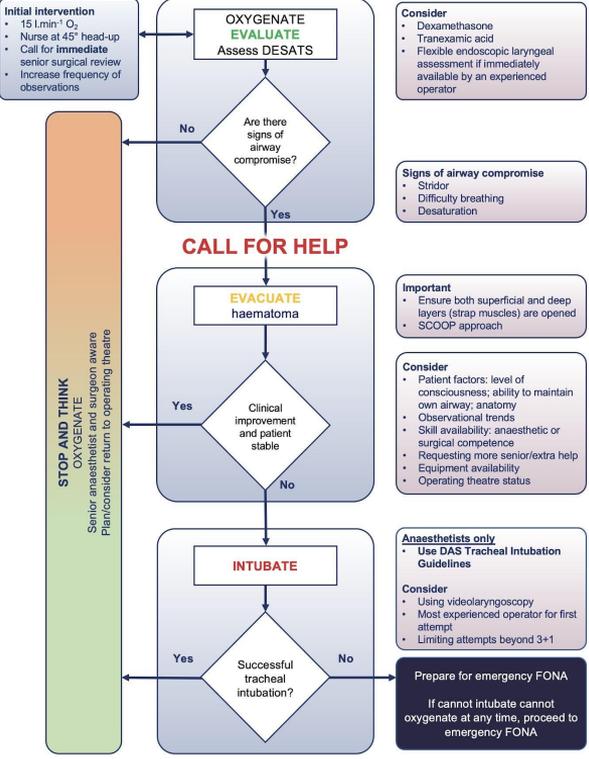


Figure 6.14 Three-way stopcock connecting the oxygen tubing to the hub of the catheter with the third arm open to the atmosphere.

A teal-colored rounded rectangle with a black outline. It features two white stars with black outlines, one in the top right corner and one in the bottom left corner. There are also several small white circles and short black lines scattered across the teal background.

COGNITIVE AIDS

Management of suspected haematoma following thyroid surgery



Post-thyroid surgery regular review

This patient requires **close postoperative observation**. This tool aims to highlight signs that require an urgent senior clinical review. As well as standard **NEWS** observations, aim to:

Closely monitor for **DESATS**

- D** - Difficulty swallowing/discomfort
- E** - EWS/NEWS
- S** - Swelling
- A** - Anxiety
- T** - Tachypnoea/difficulty breathing
- S** - Stridor

This **DESATS** acronym is to help pick up early signs which need urgent senior clinical review. We stress that desaturation and increasing oxygen requirements are a late sign of airway compromise. Act early to avoid subsequent deterioration.

If your review reveals any one or more of the above:

- OXYGENATE:** Give 15 l.min⁻¹ O₂
- Nurse at 45° head-up
- See management of suspected haematoma following thyroid surgery guideline: **EVALUATE**
- Arrange for immediate senior surgical review** (registrar or consultant) – if not immediately available senior anaesthetic review should be arranged.
- If there are any signs of airway compromise EVACUATE** haematoma and request immediate senior anaesthetic review.

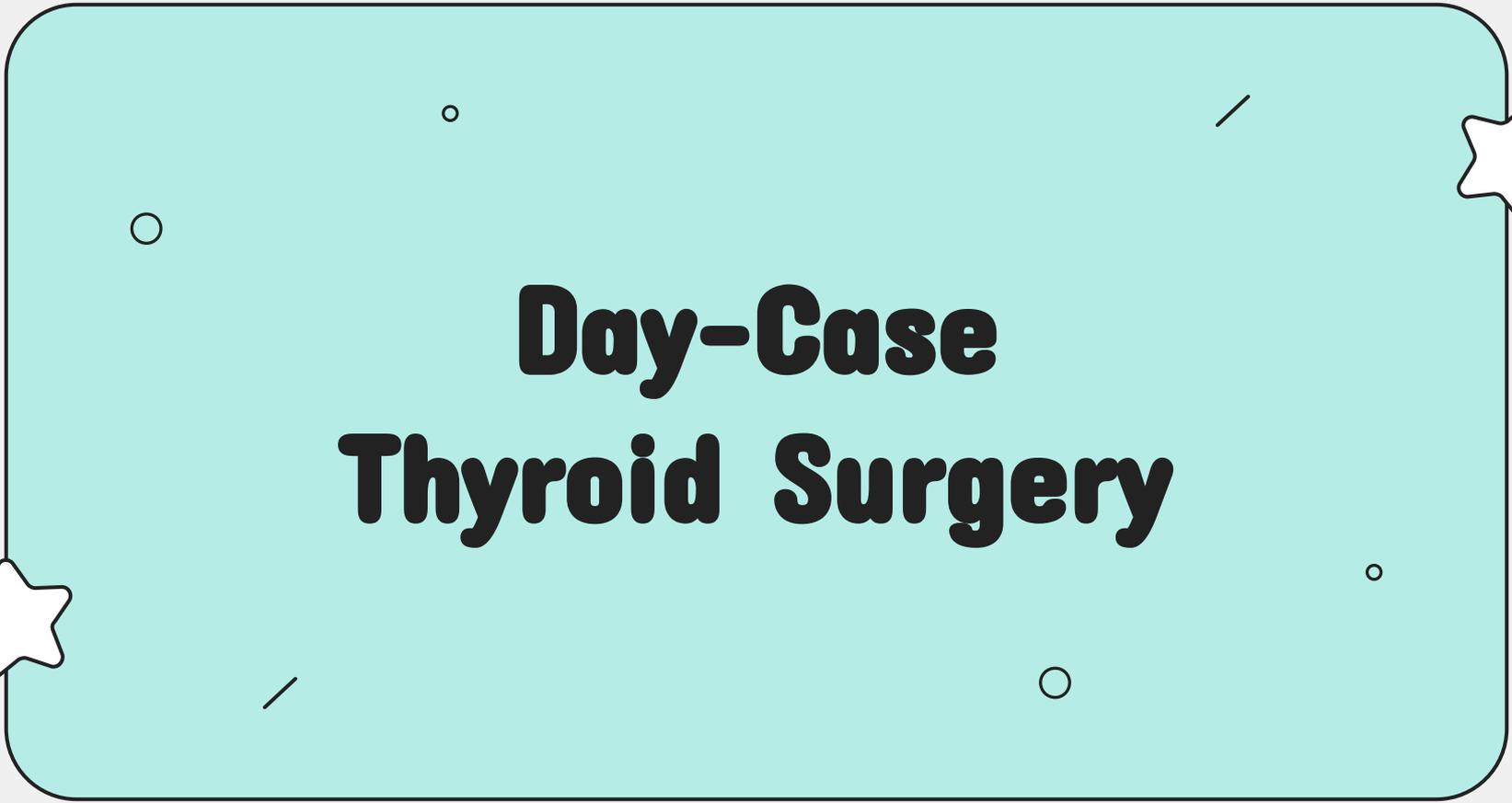
Management of acute haematoma following thyroid surgery: **EVACUATE**

*Signs of airway compromise:
Stridor; difficulty breathing; desaturation

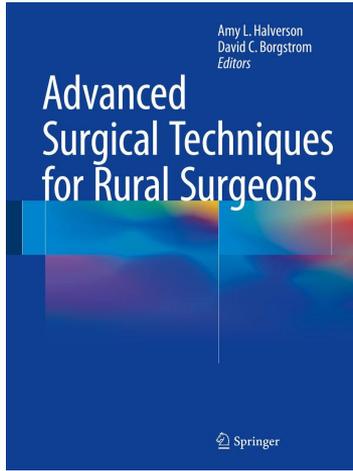


Post-Haematoma Evacuation Care

- Patients will need to return to operating theatre for definitive management and close postoperative observation
- Transfer to area with level 2 or 3 care should be considered
- Reporting of these critical incidents is warranted
- Surgical team, usually the consultant, to communicate with patient including after discharge to relieve psychological impact
 - Duty of candour letter should be sent to the patient describing what has happened and offering ongoing support
- Psychological support

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Day-Case Thyroid Surgery

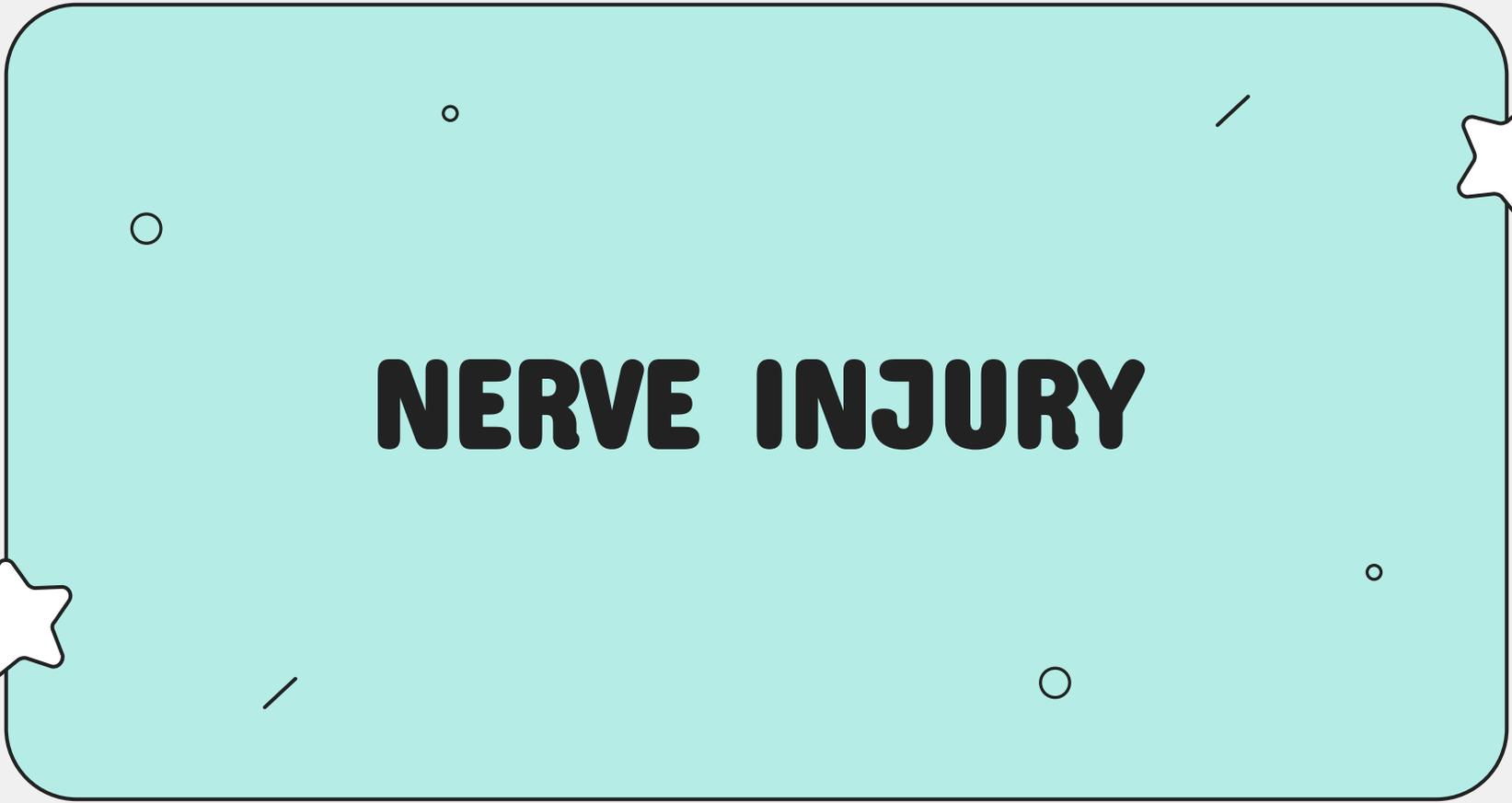


Postoperative Care

Patients are usually monitored in the PACU and short stay hospital beds for airway management. A postoperative hematoma can develop rapidly and cause airway obstruction acutely. We have a trach tray at the bedside while the patient is in the hospital. Pain is controlled with po or IV narcotics, and swallowing can be uncomfortable but patients are usually able to tolerate a normal soft diet. Patients can be monitored for postoperative hypocalcemia either clinically or with calcium levels. Our practice is to have a serum calcium level drawn the afternoon of surgery and in the following morning. Thyroid hormone replacement is usually begun as an outpatient. Our patients are routinely discharged on an oral pain medication, thyroid replacement hormone (usually synthroid 0.125 μg), and oral calcium supplements. Our preference is to have patients remain for a 24-h observation stay, but routine lobectomies in a reliable patient with strong family support have been discharged the same afternoon in selected cases.

**PATIENTS SHOULD STAY
IN HOSPITAL
AND BE MONITORED FOR
A MINIMUM OF 6 HR
POSTOPERATIVELY**

should include discussion with the patient about
possibility of haematoma at home and subsequent actions required

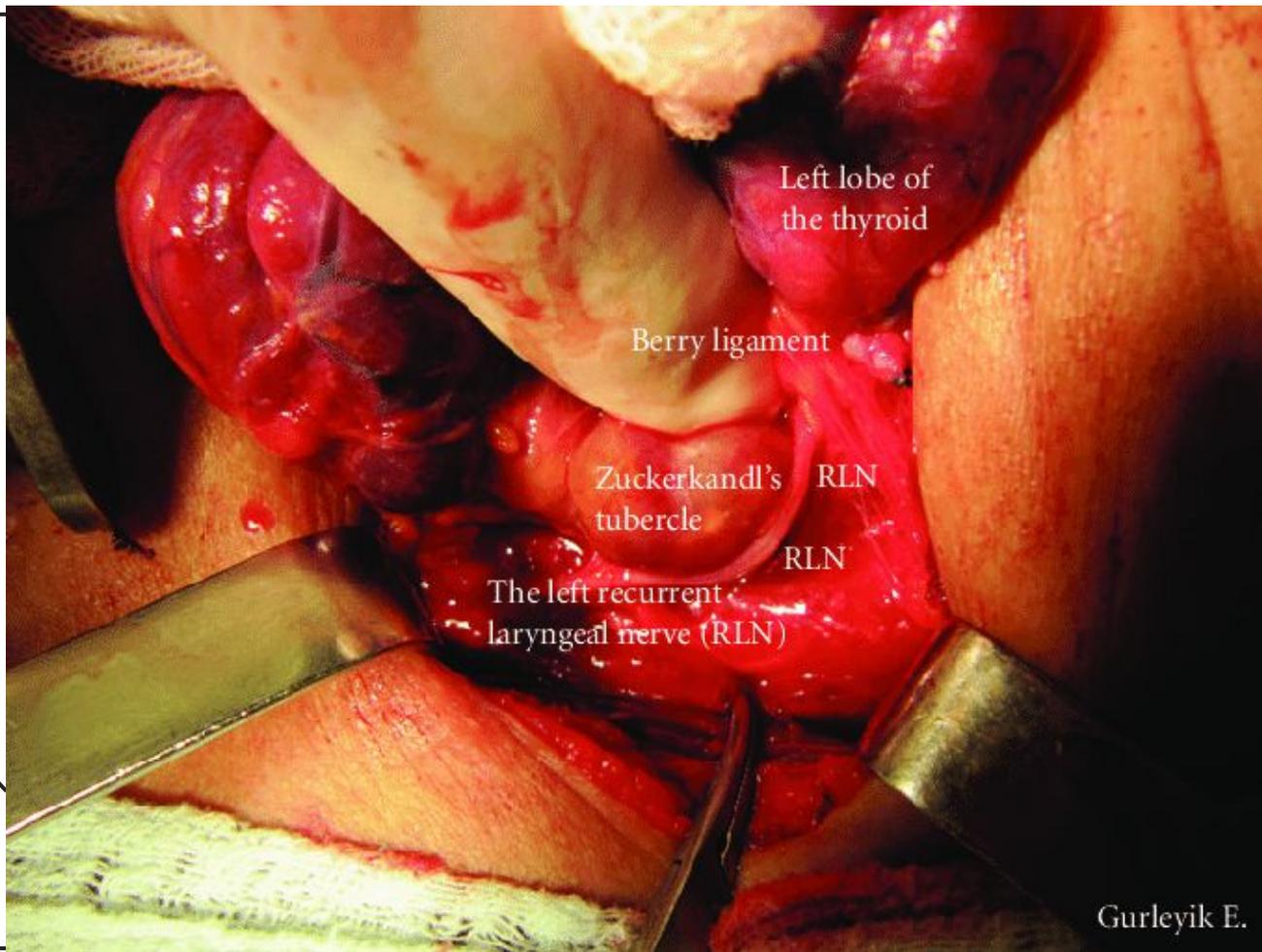
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NERVE INJURY

NERVE INJURY after POSTOPERATIVE THYROID SURGERY

RECURRENT LARYNGEAL NERVE

- Common complication
 - Incidence of RLN injury at thyroidectomy is low but not zero
 - Unilateral or Bilateral
 - Transient RLN palsy is 5-8%
 - Often resolve in 6 months (or extended to 12 months)
 - Permanent RLN palsy is 0.3-3%
- Factors may cause injury: excessive traction/stretching, contusion, clamping, ligation, suturing, burning, and cutting



Gurleyik E. Two cases of enlarged zuckerkandl's tubercle of the thyroid displacing the recurrent laryngeal nerve laterally. Case Rep Med. 2011;2011:303861.

NERVE INJURY after POSTOPERATIVE THYROID SURGERY

RECURRENT LARYNGEAL NERVE

- Risk
 - Type of surgery: Reoperation, central nodal dissection or invading adjacent structures of thyroid cancer
 - Underlying thyroid pathology
 - Extent of resection
 - Volume of surgeon's practice

NERVE INJURY after POSTOPERATIVE THYROID SURGERY

RECURRENT LARYNGEAL NERVE

Symptoms and Signs

- Hoarseness or Dysphonia
 - Laryngeal paralysis with unilateral vocal cord immobility in Unilateral RLN injury
 - Upper airway dyspnea and swallowing problems, particularly for liquids
- Shortness of breath or Stridor
 - Immediately after extubation in 86.6% of cases in Bilateral RLN injury

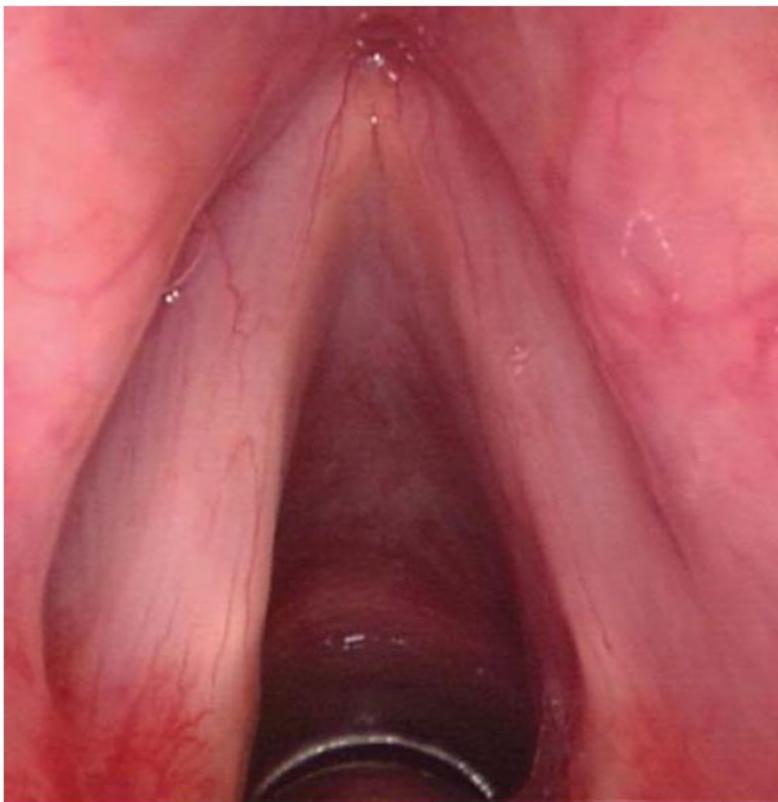


Figure 16.1 The laryngoscopic view of a vocal cord paralysis with atrophy of the paralyzed vocal cord on the right.

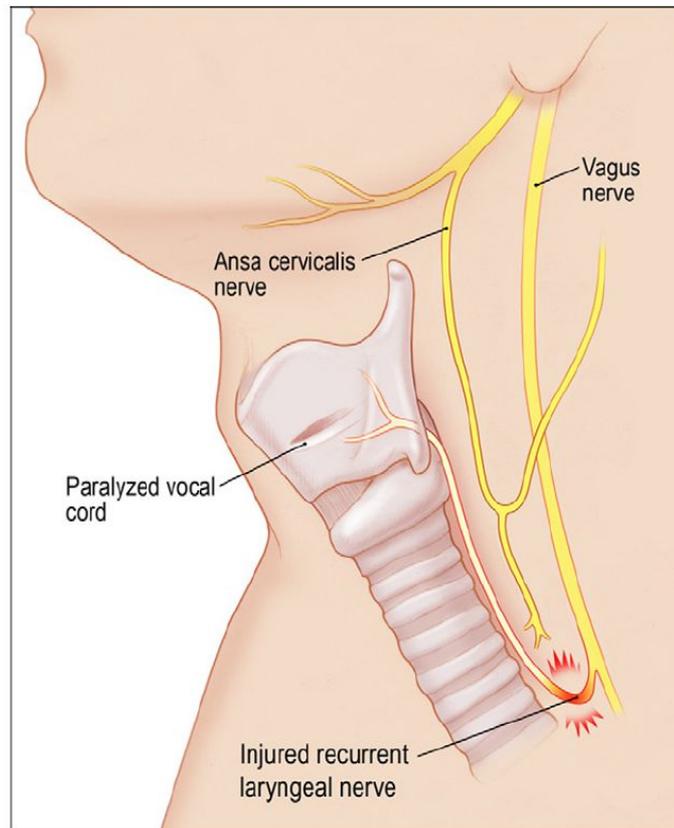
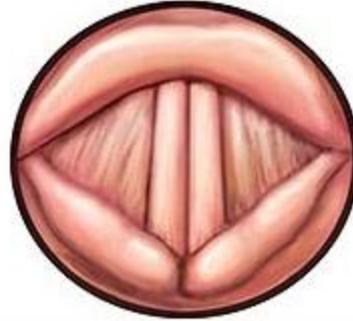


Figure 2 Illustrative case of recurrent laryngeal nerve (RLN) damage leading to unilateral vocal fold paralysis. (Image © Edward J. Damrose.) (Color version of figure is available online.)



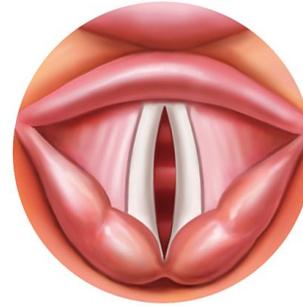
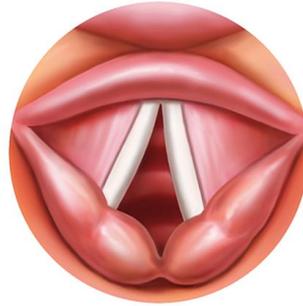
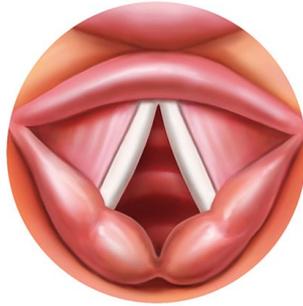
Vocal cords open during breathing to allow air into lungs.



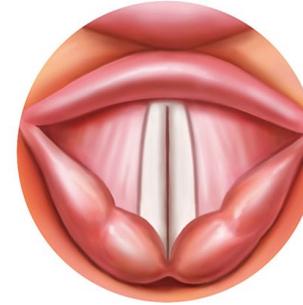
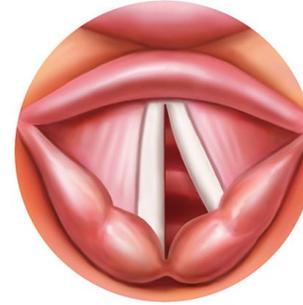
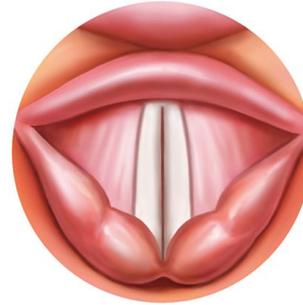
Vocal cords close when speaking so air from the lungs presses between them to cause the vibrations that produce sound.

Vocal cord paralyse

Respiration



Phonation



w/o
paralysis

unilateral
paralysis

bilateral
paralysis

NERVE INJURY after POSTOPERATIVE THYROID SURGERY

RECURRENT LARYNGEAL NERVE

Management in Bilateral vocal cord palsy

- Life threatening complication
- Require intubation and subsequent tracheostomy to stabilize airway prior to definitive treatment

NERVE INJURY after POSTOPERATIVE THYROID SURGERY RECURRENT LARYNGEAL NERVE

Management in Unilateral vocal cord palsy

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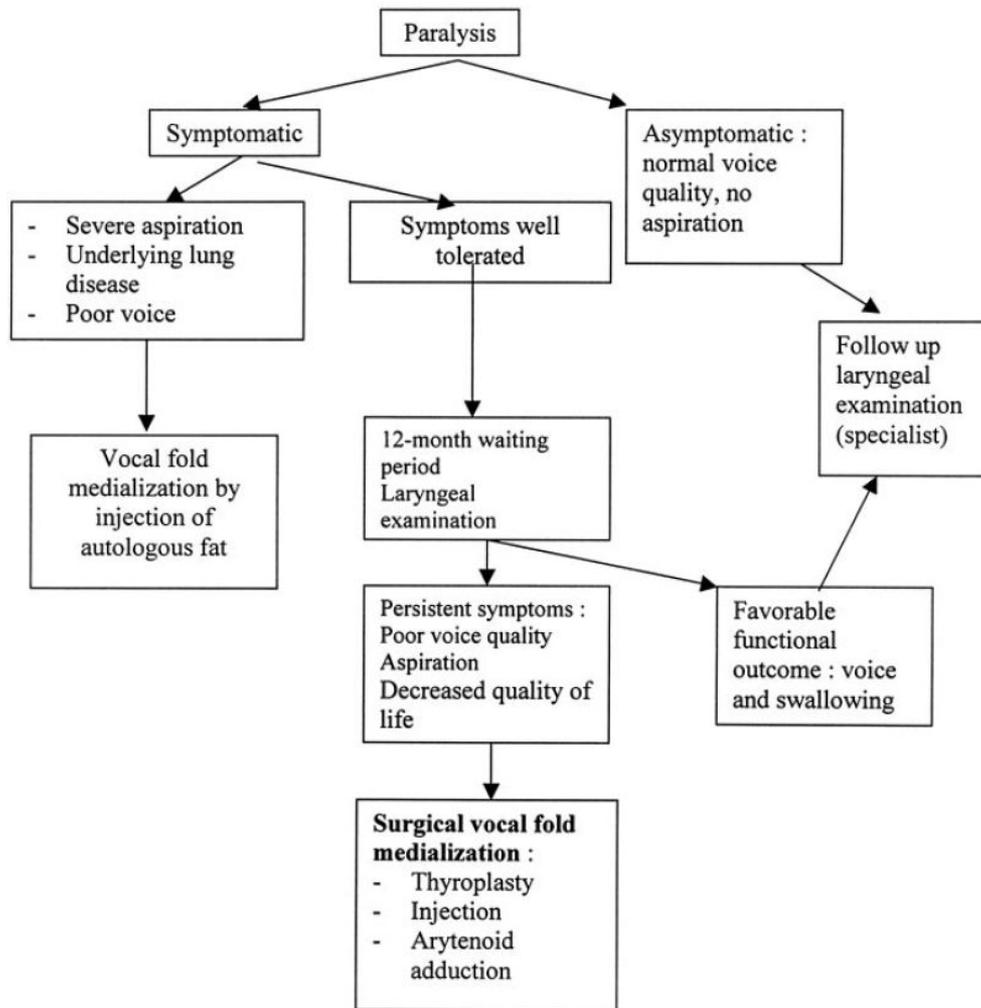
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CLINICAL REVIEW: Current Concepts in the Management of Unilateral Recurrent Laryngeal Nerve Paralysis after Thyroid Surgery

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FIG. 3. Algorithm for management of URLNP after thyroid surgery.



NERVE INJURY after POSTOPERATIVE THYROID SURGERY

EXTERNAL BRANCH OF

SUPERIOR LARYNGEAL NERVE

Symptoms and Signs

- Lower pitched or husky voice after extubation immediately
- Fatigued with a substantial reduction in phonatory frequency range
- Modest increase in phonatory instability (jitter)
- Increased laryngeal resistance with no objective evidence of glottic insufficiency
- Mild deterioration in voice quality most evident during high pitched voice productions

Signs and symptoms

<i>Symptoms from RLN damage</i>	<i>Symptoms from SLN damage</i>
<ul style="list-style-type: none">• Rough voice quality^[3]• Breathy voice quality^[4]• Vocal fold bowing^[4]• Decreased vocal fold mobility^[5]• Glottal insufficiency^[6]• Hyperfunction^[3]• Vocal fatigue• Reduced vocal stamina^[6]• Changes in voice pitch or pitch range^[6]• Difficulty varying pitch at a quick rate^[3]• Difficulty projecting voice or speaking loudly or in noisy environments ^{[3][5]}• Throat pain^[5]• Bouts of choking^[5]• Diplophonia^[3]	<ul style="list-style-type: none">• Swallowing difficulties^[4]• Chronic coughing^[3]• Globus sensation^[3]• Hypersensitivity or abnormal sensation^[6]• Vocal fold spasms^[3]• Pain from vocal use^[6]• Loss of voice in high pitch ranges^[3]

NERVE INJURY after POSTOPERATIVE THYROID SURGERY

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Incidence

- Depending upon the method of identification
 - 0%-6% when assessed via laryngoscopy
 - 58% when assessed by laryngeal electroneuromyography

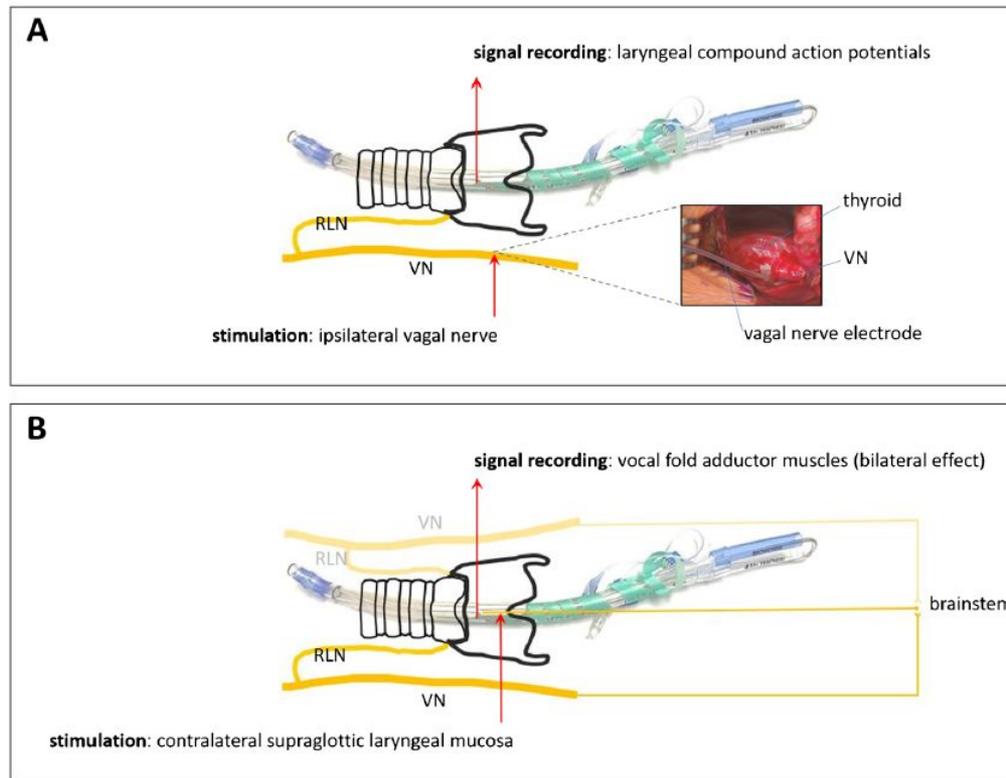


Fig. 1 Scheme of loci for stimulation and signal recording for (A) vagal/recurrent laryngeal nerve based and (B) laryngeal adductor reflex based continuous intraoperative nerve monitoring; setup for lobectomy of the left thyroid lobe. A Stimulation is performed using a vagal nerve electrode on the side, which is operated on (left thyroid lobe). Compound action potentials of the laryngeal muscles are registered. B Stimulation is performed at the supraglottic mucosa contralateral to the side, which is operated on. The laryngeal adductor reflex elicits bilateral

activity of the vocal fold adductors. The reaction from the left side surveys the operative activity and stress on the recurrent laryngeal nerve, whereas the contralateral LAR responses (in unilateral surgeries) could be used to determine, whether any decreased signal that occurs perioperatively is related to nerve stress or merely tube displacement. Currently, endotracheal tubes do not yet allow for simultaneous recording of bilateral LAR responses. VN, vagal nerve; RLN, recurrent laryngeal nerve

NERVE INJURY after POSTOPERATIVE THYROID SURGERY

EXTERNAL BRANCH OF

SUPERIOR LARYNGEAL NERVE

Management

- no surgical repair technique available to repair intra-operatively
- identified EBSLN injuries
- Speech therapy
- Vocal training
- Counseling

OTHER COMPLICATIONS for THYROID SURGERY

- Additional Complications

- ○ Cosmesis
- ○ Infection
- ○ Seroma

- Other Rare Complications

more likely to occur in the setting of revision surgery and/or central neck dissection

- ○ Injury of the great vessels
- ○ Injury of vagus nerve
- ○ Injury of sympathetic trunk
- ○ Esophageal perforation
- ○ Chyle leak

A teal-colored rounded rectangle with a black outline. It features two white stars with black outlines, one in the top right corner and one in the bottom left corner. There are also several small white circles and short black diagonal lines scattered across the teal background.

TAKE HOME MESSAGE

**THANK
YOU!**

