

Percutaneous Dilatational Tracheostomy

Consensus Statement

Version 4.0
Date: 31 March 2026

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Suggested Citation: ANZICS, Percutaneous Dilatational Tracheostomy Consensus Statement, 2026

www.anzics.org

ISBN: 978-1-876980-88-7

Originally Prepared by the Safety and Quality Committee,
Dr Tony Burrell
Dr Brett Sampson

Updated, 2014 by Safety and Quality Committee,

Dr Krishnaswamy Sundararajan
Dr Angus Carter

Updated, 2026 by Safety and Quality Committee,

Dr Hemang Doshi
A/Prof Krishnaswamy Sundararajan
Prof Deepak Bhonagiri

For further information, contact:

Chair, Safety and Quality Committee,
Australian and New Zealand Intensive Care Society
PO Box 41, Prahran VIC 3181

Conflict of Interest Declaration

Name	Organisation	Declaration
Dr Hemang Doshi	Nepean Hospital	None
A/Prof Krishnaswamy Sundararajan	Royal Adelaide Hospital	None
Prof Deepak Bhonagiri	Liverpool Hospital	None

Table of Contents

Conflict of Interest	3
Foreword	7
Introduction.....	8
Background.....	10
Purpose and Expected Outcome.....	10
Definitions.....	10
PDT Techniques	11
Indications for PDT.....	11
Airway maintenance	11
Prolonged Ventilation.....	11
Contraindications for PDT.....	11
Absolute.....	11
Relative.....	12
Specific Risks/Complications	12
Bleeding.....	13
Recommendations.....	13
Airway Injury.....	15
Recommendations.....	15
Pneumothorax /pneumomediastinum /subcutaneous emphysema.....	15
Other early complications.....	15
PDT technique.....	16

Semi-elective procedure.....	16
Preparation of Patient.....	16
Risk assessment.....	16
Consent.....	16
Fasting.....	16
Ventilator settings.....	17
Equipment.....	17
Monitoring.....	17
Procedure.....	17
Choice of Tracheostomy Tube.....	19
Personnel.....	19
Bronchoscopic Guidance.....	20
Risk/Benefit assessment of Bronchoscopic guidance.....	20
Potential benefits.....	20
Potential risks.....	20
Ultrasound guidance.....	21
Post Procedure Care.....	21
Summary.....	22
Competency.....	22
References.....	23
Appendix 1: Clinical Procedure Safety Checklists ⁶²	28
APPENDIX 2: Emergency Tracheostomy Algorithm ⁶³	31

APPENDIX 3: Tracheostomy Bedhead Sign⁶⁴ 32

Appendix 4: Imagery..... 33

Foreword

The high-quality evidence base informing many aspects of Percutaneous Dilatational Tracheostomy (PDT) remains limited, and variation in clinical practice persists. This statement was drafted by a panel of experts and subsequently reviewed by an expert working group comprising representatives from the Australian and New Zealand Intensive care Society (ANZICS) and the College of Intensive Care Medicine (CICM) and endorsed by the boards of both organisations. Recommendations are informed by the best available evidence and, where evidence is limited, by structured expert consensus.

The scope of this statement is restricted to percutaneous dilatational tracheostomy (PDT) in adult intensive care patients.

This document reflects current practice at the time of publication and will be reviewed periodically to incorporate emerging evidence and evolving standards of care.

Signed:

Dr Craig Carr

ANZICS President

Prof Deepak Bhonagiri

Chair, ANZICS Safety and Quality Committee

Members of the Expert Working Group:

Prof Deepak Bhonagiri, A/Prof Krishnaswamy Sundararajan, A/Prof Ashwin Subramaniam, Prof Daryl Jones, Dr Andrew Casamento, Dr Mairi Northcott, A/Prof Yasmine Ali Abdelhamid

Introduction

Tracheostomy is performed in Australian and New Zealand Intensive Care Units (ICUs) to facilitate weaning from mechanical ventilation, reduce anatomical dead space, avoid laryngeal injury and aid in the management of tracheobronchial and pulmonary secretions.

While the history of surgical tracheostomy dates back many centuries, the development of percutaneous dilatational tracheostomy (PDT) is more recent. In 1985, Ciaglia described a procedure that was based on a Seldinger technique, with multiple dilators¹. Subsequently, the dilators were modified to a single graded tracheal dilator². In 1990, Griggs et al described a similar guide wire single dilatation technique using modified Howard-Kelly forceps³⁻⁵. In selected ICU patients, both PDT techniques have been shown to be safe⁶⁻⁸ and have fewer complications than surgical tracheostomy⁹⁻¹⁴. Other PDT techniques exist but are not in common practice in Australasia. Surgical tracheostomy is usually reserved for patients with contraindications to PDT. The most common risks associated with PDT are haemorrhage, hypoxaemia, loss of airway, cannula misplacement, airway injury, pneumothorax, surgical emphysema, and damage to the posterior tracheal wall and accidental decannulation in the immediate peri-operative period¹⁵. Locally developed guidelines may reduce PDT-related complications^{16,37}.

Timing

Based on available evidence from randomised controlled trials^{17-20,39}, there is no mortality benefit for early tracheostomy (≤ 10 days) as compared to the late tracheostomy (> 10 days). However, early tracheostomy was associated with lower ventilator-associated pneumonia (VAP) rates, more ventilator-free days, early weaning from mechanical ventilation and a shorter ICU length of stay³⁹. Based on current evidence, we cannot recommend the ideal time frame for performing

tracheostomy. The timing of tracheostomy is the prerogative of the intensivist, dictated by the patient's clinical status.

This consensus statement is intended as a guide for the safe performance of PDT in the ICU. It concentrates on the immediate risks: bleeding, airway damage and decannulation. It is anticipated that all PDTs will be authorised by a specialist intensivist or senior intensive care clinician. It is emphasised that PDT must be performed only as an elective procedure on a stable patient by appropriately skilled staff in a controlled environment. PDT is contraindicated for emergency airway access.

Background

Purpose and Expected Outcome

The main purpose of this statement is to:

- minimise unwarranted clinical practice variation
- serve as a guide for those ICUs adopting a consensus-based approach
- identify and minimise risks associated with PDT; and
- decrease or eliminate procedure-related complications of PDT.

The expected outcome is:

- The consensus statement serves as a reference point for establishing local PDT protocols.
- Australasian intensivists will critically review the consensus statement, and in so doing, critically review and modify their own practice; accordingly, and
- Procedure-related complications of PDT will decrease.

Definitions

Tracheostomy	A tracheostomy is an artificial opening into the trachea through the neck.
Surgical Tracheostomy	Involves placement of a tracheostomy tube into the trachea by dissection and incision of the trachea under direct vision. This may be performed in the Operating Room (OR) or in the ICU.
Percutaneous Dilatational Tracheostomy (PDT)	This is almost always a bedside procedure performed using a Seldinger technique and dilatation of the trachea between the tracheal rings to facilitate placement of a tracheostomy tube.

PDT Techniques

A total of six PDT techniques have been described: multiple dilator (Ciaglia), guidewire dilating forceps (Griggs), single dilator (modified Ciaglia or *Blue Rhino™*), rotating dilation (*Percutwist™*), balloon dilation²¹ (*Ciaglia Blue Dolphin™*), and translaryngeal³⁸ (Fantoni), though the following three are used commonly in Australasia.

- **Ciaglia's multiple dilators.** This Seldinger-based technique involves cannulation of trachea between 1st & 2nd or 2nd & 3rd tracheal ring with a guide wire. This is followed by graded dilatation of the trachea using multiple dilators to facilitate tracheostomy tube placement
- **Single graduated dilator technique.** This is a modification of the Ciaglia technique in which a single graded dilator replaced the multiple dilators.
- **Griggs Technique.** This is a Seldinger-based technique similar to Ciaglia but involves a single step dilatation of trachea using modified Howard-Kelly forceps.

Indications for PDT

Airway maintenance

- Upper airway obstruction.
- Inability to protect the airway.

Prolonged Ventilation

- Prolonged dependence on mechanical ventilation (actual or anticipated).
- Secretion management.
- Permanent or long-term airway access in traumatic or neurological diseases.

Contraindications for PDT

Absolute

- Informed consent not obtained (see below).

- Uncontrolled coagulopathy with high risk of active bleeding.
- Infection (uncontrolled) at the planned insertion site.

Relative

- Known or suspected difficult intubation, i.e. possible difficulty in managing the airway during the procedure.
- Cervical instability: When deliberating PDT versus surgical tracheostomy in a patient with cervical spinal injury, careful consideration of the potential risks is strongly recommended. Any consideration of tracheostomy (surgical or PDT) should only occur after appropriate consultation with neuro or spinal surgeons and surgical fixation of the spine if indicated.
- Difficult anatomy: e.g. morbid obesity (BMI >40 kg/m²), short neck, minimal neck extension, high or aberrant (cervical) innominate artery, large pre-tracheal vessels, tracheal deviation, Anatomical anomalies: e.g. anterior neck mass, large goitre.
- Platelet count <50 x 10⁹ per litre (or severe platelet dysfunction).
- Significant renal impairment with haematological issues that could influence haemostasis.
- INR >1.5, activated partial thromboplastin time (APTT) >50sec or prolonged prothrombin time.
- Therapeutic anticoagulation, especially when also on dual antiplatelet drugs ⁴⁸.
- Compromised respiratory function: severe hypoxemia: PaO₂/FiO₂ <100 mmHg, with positive expiratory pressure (PEEP) >10 cmH₂O ³⁷
- Paediatric patients (<18 years of age): Consider anatomical factors and surgical backup ⁴³.

Specific Risks/Complications

Overall peri-procedural complication rates for PDT vary from 4-9%, with minor bleeding and desaturation being the most common^{7, 15, 22}. Obesity may be an independent risk factor for peri-

operative complications. The overall reported tracheostomy-related complication rate was 16.6% in a systematic review and meta-analysis of 791 patients involving 17 studies, though most of them were non-life-threatening⁴², and the mortality directly associated with the procedure in individuals with obesity was 0.3% in the 15 studies⁴².

Bleeding

Bleeding is the most common complication reported in all studies, with up to 8% of patients bleeding from the insertion site^{24, 25}. Most bleeding is low volume and usually seen in patients with a bleeding diathesis. Life-threatening and fatal bleeding from aberrant vascular anatomy is very rare. Risk factors for bleeding are chronic kidney disease, platelet count $<50 \times 10^9/\text{mCL}$, aPTT >50 sec and the presence of two or more abnormal coagulation variables^{25,51}. In a systematic review of 32 studies undergoing pulmonary procedures on antiplatelets or anticoagulants, there was inconsistent or inconclusive evidence for bleeding risk from single antiplatelet, dual antiplatelet therapy or therapeutic anticoagulation⁵².

Recommendations

- Consider platelet transfusion prior to PDT when platelet count is $< 50 \times 10^9/\text{mCL}$.
- Careful consideration should be given to balance the increased risk of bleeding for patients receiving dual antiplatelet therapy^{48,52}.
- Consider postponing PDT for a minimum of 12 hours following therapeutic Low Molecular Weight Heparin (LMWH) administration⁴⁹ and at least 48 hours following direct oral anticoagulants administration^{49,50}.
- Cease intravenous therapeutic heparin infusion for a minimum of 4 hours and check aPTT is <50 seconds prior to PDT.
- Consider reversal of anticoagulation /correction of coagulopathy if international normalised ratio (INR) > 1.5 , activated partial thromboplastin time (aPTT) >50 seconds.
- Consider clotting factor replacement for specific deficiencies, e.g. Haemophilia.

Airway Injury

The most serious, albeit rare, injury is splitting of the posterior tracheal wall. The most likely cause is that the locating needle (and hence guide wire) transfixes the trachea, causing the dilator to pass through and tear the posterior wall. The use of a bronchoscope may potentially prevent this injury by confirming that the guide wire is correctly placed within the trachea prior to dilatation (see below).

Recommendations

- Extreme care should be taken to ensure the needle/cannula is in the lumen of the trachea prior to guide-wire placement and subsequent dilatation.
- Bronchoscopic guidance of needle insertion and guide-wire placement into the trachea should be considered for every procedure following a risk/benefit assessment for each patient (see below).

Pneumothorax /pneumomediastinum /subcutaneous emphysema

May be caused by:

- Perforation of the posterior tracheal wall.
- Tangential needle passage through the trachea.
- Volutrauma caused by air-trapping during ventilation with bronchoscope in situ.
- Inappropriate placement of the tracheostomy tube anterior to the trachea; and
- Air leak from the tracheal incision trapped by a tight skin wound causing subcutaneous emphysema of the neck.

Other early complications

- Airway obstruction by clots, sputum plug or herniated tracheostomy cuff.
- Accidental decannulation with loss of airway (see below).

PDT technique

Semi-elective procedure

PDT is a semi-elective procedure; therefore, all appropriate staff and equipment should be available, with the potential for other distractions minimised. Similarly, the procedure should be performed during normal working hours when support staff is most readily available. The use of a structured procedural safety checklist is strongly recommended in accordance with local institutional policy. This should incorporate pre-procedural, intra-procedural ('time-out'), and post-procedural components. A suggested template is provided in the Appendix to this statement; however, it should be adapted to align with local governance requirements and clinical practice frameworks. These checklists may be integrated into Electronic Medical Records documentation, where available, to streamline record-keeping.

Preparation of Patient

Risk assessment

An intensivist or senior trainee performs a risk/benefit assessment of the procedure for an individual patient, including a review of absolute and relative contraindications. A thorough clinical examination of the anterior neck anatomy must be performed with additional imaging as indicated (e.g. ultrasound or radiological)^{26, 37, 41}. Ultrasound aids in the identification of the neck landmarks as well as aberrant pre-tracheal vasculature, hence avoiding the risk of injury to the thyroid and blood vessels^{37,44}.

Consent

Informed consent must be obtained and documented in the patient's notes according to jurisdictional requirements.

Fasting

It may be sufficient to stop naso-gastric feeds and aspirate through a wide-bore naso-gastric tube prior to the procedure. Alternatively, or if a fine bore tube is used, a minimum of 4 hours of fasting is recommended.

Ventilator settings

Pre-oxygenation and maintenance of a FiO₂ of 1.0 throughout the procedure is recommended.

Ventilator settings should be appropriate for the anaesthesia given and the ventilation requirements of the patient. It may be necessary to modify airway pressure upper limit alarms when bronchoscopy is being utilised.

Equipment

All appropriate equipment should be readily available. This must include equipment for emergency management of the airway. A fibre optic bronchoscope must be readily available. The equipment must be checked for completeness and functionality.

Monitoring

Monitoring must include the following:

- Pulse rate.
- Blood pressure.
- Pulse oximetry (SpO₂).
- ECG
- Capnography -for confirming ventilation during PDT and correct placement of tracheostomy tube.

Procedure

The procedure should be performed in an appropriate area with adequate lighting and sufficient space for satisfactory infection control. All equipment required for the procedure must be available at the bedside.

PDT is usually performed under combined general and local (with vasoconstrictor) anaesthesia.

The use of Bronchoscopic guidance is discussed below.

The patient is placed in a supine position (or slight head up) with the neck extended. A rolled-up towel or pillow placed between the scapulae may improve access to the trachea. The

endotracheal tube (ETT) is withdrawn carefully. The cuff should remain just above the vocal cords. If too low the endotracheal tube may be damaged in the course of the tracheostomy. Rarely the wire may be passed through the Murphy's eye of the ETT. The use of a laryngeal mask airway (LMA) for airway management during PDT has also been described^{31,60}.

Strict sterile precautions are mandatory and should comply with local institutional policy. The patient must be fully draped with sterile sheets, and the operator must don cap, mask, gloves, sterile gown and protective shield for eyes.

Techniques for tracheal cannulation vary from skin incision, blind dilation and tracheal palpation followed by tracheal puncture to percutaneous tracheal puncture followed by skin incision. The choice is best left with local and personal expertise. The tube should be placed preferentially between the 2nd and 3rd rings⁴⁰ or failing this the 1st and 2nd rings. Tracheostomy below the 3rd ring should be avoided to prevent the risk of injury to the innominate artery. A tracheostomy performed between the cricoid cartilage and the first tracheal ring may damage the cricoid and increase the risk of subglottic stenosis.

Successful placement of needle and guidewire in the trachea should be confirmed with bronchoscopy either real-time or post insertion. Final placement of the Tracheostomy tube in the trachea must be confirmed by waveform capnography, and the tracheostomy tube must be secured after that. It is the responsibility of the doctor performing, or supervising the procedure, to ensure the tracheostomy tube is secured meticulously with the ties, or in line with local policies. The ETT should not be removed until the tracheostomy tube has been secured, and, when clinically appropriate, suctioning through the endotracheal tube should be considered prior to removal to reduce supraglottic secretions. Following tracheostomy tube placement, Bronchoscopic evaluation may be performed either via the endotracheal tube or trans orally to assess tracheal ring integrity, confirm tracheostomy cuff position, and identify any tracheal or supraglottic injury.

Choice of Tracheostomy Tube

In a patient with a larger neck (e.g. obesity, skin to tracheal depth >1 cm) or altered airway anatomy, consideration should be given to the use of a longer tracheostomy tube (e.g. *UniPerc™*, *Shiley™ XLT*) as a too-short tracheostomy tube may increase the risk of air leak, accidental decannulation and aspiration^{53,54,55}. A tracheostomy tube with above cuff suction line (e.g. *Suctionaid™*) can be considered, given its potential benefits for secretion management and above-cuff vocalisation⁶¹.

Personnel

All PDTs should be authorised by the intensivist or responsible senior clinician. The operator should be a fully trained intensivist, experienced senior practitioner or an ICU advanced trainee who has performed independent procedures in the past and has been assessed to be competent in PDT. If the trainee operator has not been assessed to be competent, they should be closely supervised by an intensivist or senior medical practitioner experienced in PDT. The supervising doctor must be able to immediately render assistance to the trainee during all stages of the procedure.

The doctor responsible for the anaesthetic will be responsible for the airway, monitoring and sedation as needed. Hypoxia and loss of patent airway leading to potentially life-threatening complications have been reported⁵⁹. A skilled airway doctor to exclusively manage the airway is therefore mandatory in the peri-procedural period. If the airway doctor is also performing a bronchoscopy, they must be able to immediately respond to an airway emergency.

At all times a senior doctor, competent in PDT, should be available for consultation and assistance during the procedure. Surgical skills should be available if significant bleeding or other complication occurs. There must be adequate nursing assistance.

Bronchoscopic Guidance

Fibre optic bronchoscopy is highly recommended to identify the point of needle insertion into the trachea and confirm correct guidewire placement²⁷. The use of a bronchoscope may also facilitate teaching and supervision of inexperienced operators. Bronchoscopic guidance may potentially minimize the risk of complication(s), especially posterior tracheal wall injury and assists with the identification of tracheal rings during the needle puncture.^{9,27-30}. However, bronchoscopy can increase procedural time, costs and complexity of PDT. To minimize the risk of volutrauma, the bronchoscope should be removed once the guide-wire placement is confirmed. Alternatively, a thin intubating bronchoscope can be used. A post procedural bronchoscopy through the tracheostomy tube may be performed to check tracheostomy position and for clot occlusion or cuff herniation.

Risk/Benefit assessment of Bronchoscopic guidance

Potential benefits

- Reduced risk of:
 - Accidental loss of airway.
 - Posterior tracheal wall injury.
 - False passage of wire, dilator and tracheostomy.
 - Pneumothorax and pneumomediastinum.
 - Bleeding.
 - Inadvertent Extubation
- Facilitate teaching and supervision.

Potential risks

- Partial occlusion of the endotracheal tube and airway leading to:
 - Pneumothorax, secondary to air trapping.

- Carbon dioxide retention.
- Hypoxia.
- Increased complexity of procedure.
- Distraction from airway management (when there is not a dedicated bronchoscopist).
- Damage to the bronchoscope by needle puncture.

Ultrasound guidance

Ultrasound guided PDT techniques have been described^{32-35, 44,45}. Real-time ultrasound-guided tracheal puncture may result in a higher first-pass success rate^{44, 45}.

Ultrasound is recommended for:

- Defining the relevant neck anatomy, especially in morbidly obese patients.
- Identifying tracheal midline.
- Identifying blood vessels adjacent to the PDT insertion site, reducing the risk of bleeding.
- Identifying anatomical variants of the thyroid, including the presence of an aberrant or pyramidal lobe of the thyroid gland, which may include procedural risk.
- Estimating trachea depth from the skin surface and tracheal diameter, thus assisting in the selection of tracheostomy tube size and type^{53,54}.
- Ensuring accurate placement of the needle into the trachea; and
- Identifying patients unsuitable for PDT.

Post Procedure Care

A chest X-ray should be taken following the procedure to confirm tracheostomy tube position and rule out complications, e.g. intrapulmonary aspiration, pneumothorax, pneumomediastinum and lung collapse. The patient may be sat up in bed but should be repositioned with care to avoid tracheostomy tube dislodgement. Whenever the patient is repositioned a dedicated nurse or doctor must be responsible for holding the tracheostomy tube to prevent dislodgement.

If a newly inserted (< 72 hours) tracheostomy tube dislodges, orotracheal intubation is the safest

method to re-establish a patent airway. If orotracheal intubation attempts fail, an LMA is recommended to secure the airway. No attempts should be made to re-advance the dislodged tracheostomy tube through the newly formed PDT tract.

Multidisciplinary team-based care should be adopted during ICU admission and post-ICU discharge to enhance patient outcomes, including the use of speaking valves and the reduction of time to decannulation^{56,57}.

Competency

Competency for PDT requires proficiency in patient assessment, ultrasound guidance, Seldinger procedural technique), and management of complications. Training often involves simulation or supervised clinical practice, with workplace competency assessments ([WCAs](#)) completed during intensive care training. Key competency requirements include:

- **Procedural Technique:** Mastery of bedside PDT using the Seldinger technique, usually involving bronchoscopic guidance.
- **Safety & Management:** Ability to manage complications such as bleeding, hypoxia, or dislodgement, and understanding emergency airway management.
- **Assessment & Care:** Proficiency in post-procedure care, including tube changes and stoma management, often guided by local guidelines, such as those from [NSW Agency for Clinical Innovation](#).⁶²
- **WCA Accreditation:** CICM trainees must complete specific Workplace Competency Assessments for tracheostomy insertion and management, with revised standards effective from November 2025.³⁶

Detailed competencies assessment can also be accessed from ESICM COBATRICE⁵⁸.

Summary

PDT is safe when performed on appropriately selected ICU patients, by competent intensive care doctors, in an ICU setting equipped to respond immediately to airway and surgical emergencies. Surgical tracheostomy is usually reserved for patients with contraindications to PDT.

End of Percutaneous Dilatational Tracheostomy – Consensus Statement

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Appendix 1: Clinical Procedure Safety Checklists⁶³

Data was extracted and modified from *MetavisionSuite^R* Electronic Record in Intensive Care (*ERIC*), an internal NSW Health electronic medical record system.

Procedure: Percutaneous Tracheostomy

Date/Time: _____

Checklist 1: SIGN IN – Before Induction of Anesthesia / Sedation

Patient / Carer has confirmed	<input type="checkbox"/> Identity <input type="checkbox"/> Site <input type="checkbox"/> Procedure <input type="checkbox"/> Consent
Site marked	<input type="checkbox"/> Yes <input type="checkbox"/> No
Anesthesia / Sedation safety check completed	<input type="checkbox"/> Yes <input type="checkbox"/> No
Pulse oximeter and Capnography on patient and functioning	<input type="checkbox"/> Yes <input type="checkbox"/> No
Does patient have a known allergy / adverse reaction?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Does this patient need antibiotic prophylaxis? If yes, has it been given within the last 60 min?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Other (Comment)
Has the patient received thromboprophylaxis/Anticoagulant has been appropriately withheld?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Pressure injury prevention plan implemented	<input type="checkbox"/> Yes <input type="checkbox"/> Not Applicable
Known difficult airway / aspiration risk	<input type="checkbox"/> Yes, and equipment/assistance available <input type="checkbox"/> No

Checklist 2: TIME OUT – Prior to Commencement of Procedure

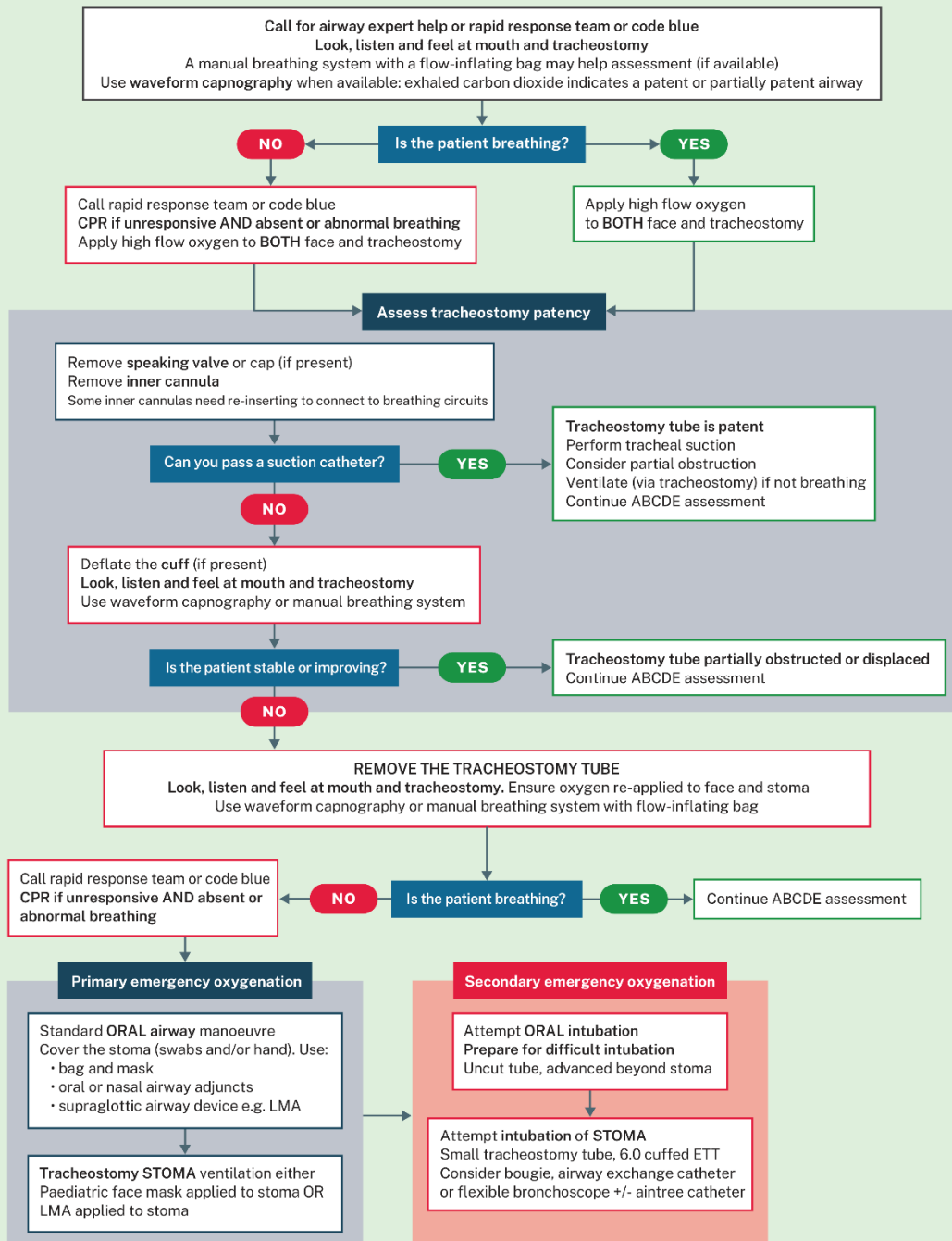
Confirm all team members have introduced themselves by name and role	<input type="checkbox"/> Yes <input type="checkbox"/> No
Patient position Optimised	<input type="checkbox"/> Yes <input type="checkbox"/> No
Proceduralist, Team Leader, and Nurse verbally confirm	Patient: <input type="checkbox"/> Yes <input type="checkbox"/> No Site: <input type="checkbox"/> Yes <input type="checkbox"/> No Procedure: <input type="checkbox"/> Yes <input type="checkbox"/> No Allergies: <input type="checkbox"/> Yes <input type="checkbox"/> No
Anticipated critical events – Proceduralist/Airway person reviews	Critical/Unexpected steps:
Anaesthesia/sedation team reviews	Patient-specific concerns <input type="checkbox"/> Yes <input type="checkbox"/> No
Nursing team reviews	Sterility confirmed <input type="checkbox"/> Yes <input type="checkbox"/> No equipment issues or any concerns <input type="checkbox"/> Yes <input type="checkbox"/> No

Checklist 3: SIGN OUT – Post procedure Checklist

Tracheostomy is well secured as per local policy	<input type="checkbox"/> Yes <input type="checkbox"/> No
Tracheostomy Confirmation	<input type="checkbox"/> Clinical <input type="checkbox"/> End-tidal CO ₂ <input type="checkbox"/> CXR <input type="checkbox"/> Bronchoscopy
Tracheostomy Care plan	<input type="checkbox"/> Standard Nursing Care <input type="checkbox"/> Enhanced Care <input type="checkbox"/> Other _____
VTE Prophylaxis/Anticoagulation plan discussed and documented	<input type="checkbox"/> Yes <input type="checkbox"/> No
Tracheostomy immediate complications	<input type="checkbox"/> None <input type="checkbox"/> Bleeding <input type="checkbox"/> Subcutaneous Emphysema
Tracheostomy Inner Cannula checked	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Comment.....
Cuff pressure	_____ cmH ₂ O
Trache Insertion Date:	___ / ___ / _____
Trache Change Date:	___ / ___ / _____
Tracheostomy Type:	<input type="checkbox"/> Percutaneous <input type="checkbox"/> Surgical
Tracheostomy Size:	_____ mm
Trache Weaning	<input type="checkbox"/> Trial Started <input type="checkbox"/> Plan Discussed <input type="checkbox"/> Not Applicable

APPENDIX 2: Emergency Tracheostomy Algorithm⁶⁴

Emergency tracheostomy management - patent upper airway



Intensive care NSW
Based on UK National Tracheostomy Safety Project.
www.tracheostomy.org.uk

ACI_2863 (06/21)

APPENDIX 3: Tracheostomy Bedhead Sign⁶⁵

This patient has a
TRACHEOSTOMY
There is a potentially patent upper airway (intubation may be difficult)

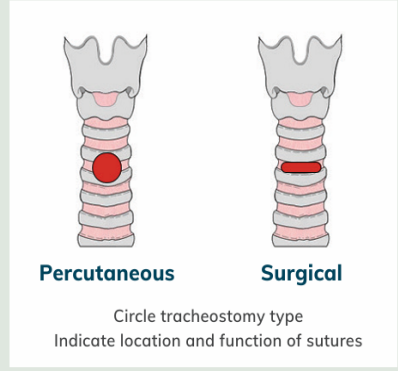
Use **emergency tracheostomy management**
– **patent upper airway** algorithm if breathing difficulties

Name

Performed on (date)

Tracheostomy tube size (if present)

Emergency? Call code blue (emergency button / 2222)
Concerned? Rapid response team (via paging system)
Need more help? ICU specialist / anaesthesia / ENT (via switch)



Laryngoscopy grade/ease of mask ventilation/
other e.g. wires/bands (location)



Intensive Care NSW
Based on UK National Tracheostomy Safety Project.
More information at www.tracheostomy.org.uk

Published: Oct 2021 Review date: 2026 © State of New South Wales (Agency for Clinical Innovation) SHPN (ACI) 210761 | ACI-2863 [08/21]

Appendix 4: Imagery



Fig 1 Standard cuffed tracheostomy tube with a subglottic suction port.
Portex Blue Line Ultra® Suctionaid Tracheostomy Tube; Smiths-Medical



Fig 2 Standard cuffed tracheostomy tube with a subglottic suction port.
Portex Blue Line Ultra® Tracheostomy Tube; Smiths-Medical



Fig 3 Extendable-length tracheostomy tube.
UniPerc® Adjustable Flange Extended-Length Tracheostomy Tube; Smiths-Medical



Fig 4 Fenestrated tracheostomy tube with fenestrated and non-fenestrated inner cannula.
TRACOE® twist (TRACOE medical GmbH).



Fig 5 Tracheostomy tube with Proximal extended length
Shiley™ XLT extended length tracheostomy tube, Medtronic™



Fig 6: Percutaneous Tracheostomy kit
Portex™ BLUperc™ Percutaneous Dilator Kit; Smiths-Medical



Fig 7: Tracheostomy Tube Inner Cannula