SASKATOON HEALTH REGION

SUCTIONING ARTIFICIAL AIRWAYS in ADULTS

Tracheostomy and Endotracheal Tubes

RN & GN LEARNING PACKAGE

RN SPECIALTY PRACTICE – RN PROCEDURE

- **Suctioning Adult Clients with Endotracheal Tubes**

Registered and Graduate Nurses identified by their Manager will be certified to perform suctioning via endotracheal tubes in accordance with the policy of the clinical unit.

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* Pediatric information is included in Suctioning Artificial Airways: Pediatric/Neonate learning package.

Special Thanks to:

Clinical Nurse Educators Urban Acute Care, Saskatoon Health Region

Clinical Nurse Educators Rural Sector, Saskatoon Health Region

Site Representatives for Acute Care, Saskatoon Health Region
Respiratory Therapy and Physiotherapy

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1.0 GENERAL INFORMATION

1.1. Criteria for Certification

- Review of the learning package and completion of the review questions.
- Satisfactory demonstration of the clinical skills to a Clinical Nurse Educator or designate in a client and/or lab setting.

1.2. Criteria for Recertification

- Recertification is required annually for RNs and GNs who are not performing the skill regularly.
- Recertification may be done upon the request of the Manager of Nursing, Director of Care (LTC), Clinical Nurse Educator or the individual RN.

2.0 THEORY

2.1. Assessing the Need for Suctioning

A client with a tracheostomy or endotracheal tube is less able to increase intrathoracic pressure for an effective cough to clear secretions. This is because the artificial airway holds the vocal cords open which normally close just prior to a cough. Initially, a tracheostomy tube may cause increased secretions due to irritation.

Since tracheal suctioning may cause complications, suctioning should be done only when there is exudate present in the upper airways, which the patient is unable to clear by coughing. Routine suctioning should be avoided as this will increase chance of mucosal trauma and risk of infection. Remember that crackles and wheezes are rarely cleared with suctioning because they indicate obstruction or fluid in the lower airways, which are inaccessible to suctioning. Chest physiotherapy and positioning may move secretions up from the lower airways, making it more accessible to suctioning.

Humidification of inspired air and systemic hydration assist to:

- Keep secretions thin, easier to move/remove
- Reduce need for suctioning if patient can raise own secretions
- Prevent tube occlusion from thick/dried secretions
- Counteract insensible fluid losses
- Compensate for bypass of upper airway
- Maintain moist mucous membranes to maximize mucocilliary transport in the lower airways

Complications of decreased humidification are: atelectasis, tracheitis, pulmonary infection, obstruction, death.

Complications of over humidification are: excessive moisture into dependent bronchi, tracheal burns if humidity temperature is excessive, infection.

The need for suctioning varies from client to client, and with client condition. For example: a client with pneumonia and copious secretions may need to be suctioned every 10 minutes to maintain airway patency and allow for ventilation. On the other hand, a client without lung disease, who has been intubated only for ventilation, i.e. neuromuscular disease, may need to be suctioned only once a shift.

2.1.1. Signs and Symptoms Indicating a Need for Suctioning

- Dyspnea, tachypnea, apnea
- Change in respiratory pattern
- Increased respiratory rate
- Change in heart rate and rhythm
- Restless and agitation or decreased LOC

- Noisy respirations/abnormal breath sounds: gurgling, or decreased breath sounds
- Decreased $Sp0_2$ or deterioration of blood gases
- Deterioration in patient's color, cool skin
- Use of accessory muscles, nostril flaring
- Ineffective coughing
- Increased peak airway pressure on ventilator
- Secretions in the airway

Clients with the following conditions are more likely to react adversely to suctioning. Suction these clients with caution.

- Increased intracranial pressure
- Hemodynamic instability
- Recent surgery to the chest and pulmonary structures
- Pulmonary hemorrhage
- Extreme reactive bradycardia (i.e. when the heart rate drops dramatically in response to suctioning)
- Hyperactive airways

When clinical indicators of the need for suctioning exist, there are no absolute contraindications to suctioning:

2.2. Preparing the Client and Equipment for Suctioning

2.2.1. Preparing the Client

Suctioning is an uncomfortable and often frightening procedure:

- The client is intubated and is therefore unable to vocalize
- The presence of the catheter in the trachea may make the client highly anxious and restless
- Suctioning may cause hypoxemia
- The client may have a smothered feeling

An explanation regarding the purpose of tracheal suctioning should be given to the client and/or family prior to suctioning and throughout the procedure each time the procedure is done.
Important points to tell the client and family include:

- Why the client requires specific aspects of care (i.e. intubation, suctioning, oxygen before the procedure, instillation of saline)
- Any other aspects of care regarding the individual needs of the client

The client may benefit from frequent reassurance and instruction on how to assist the nurse during the procedure. Often during the procedure, the client instinctively wants to pull at the catheter, especially when the cough reflex is stimulated. Warn the client that the procedure will make him/her cough. Restraints may be necessary, especially in the cognitively impaired clients, and with children.

To allay patient fears, suctioning must be performed with confidence and speed.

Positioning the Client

Position the client with head of bed elevated 30 – 45 degrees or in appropriate position for postural drainage unless medically contraindicated (i.e. unstable spinal fractures). This promotes deep breathing and effective coughing by allowing maximum movement of the diaphragm.

Oxygenation

If required, extra oxygen may be given before and after each episode of suctioning. This is most often done with ventilated patients. In the non-ventilated patient, extra oxygen can be provided using a manual resuscitation bag attached to oxygen or increase oxygen flow, if needed. If extra oxygen is not needed, encourage the patient to take several deep breaths before and after each suctioning pass.

Hyperoxygenation

Hyperoxygenation refers to the administration of oxygen at a greater concentration than the client is receiving or usually requires. It is performed before, during, and after suctioning, based on assessment of the client's respiratory status. Hyperoxygenation can be performed by an assistant giving 5 – 6 ventilations using a resuscitation bag with supplemental 0_2, or by the patient taking several large breaths while receiving a higher than normal concentration of oxygen, or in the ventilated patient by increasing the ventilator $Fi0_2$. Note: to hyperoxygenate by ventilator requires 1 – 2 minutes before dead space in the ventilator is cleared. It is well documented that a decrease in arterial oxygenation occurs during the tracheal suctioning procedure. The decreased arterial oxygen tension following tracheal suctioning has been found to lead to cardiac dysrhythmias, hypotension, and death. Tachycardia may occur as a reflex response to compensate for the suction-induced hypoxemia. Hyperoxygenation minimizes suction-induced hypoxemia by maintaining the $Pa0_2$ levels throughout the suctioning period. Manual ventilation (like mechanical ventilation) also minimizes hypoxemia due to suctioning-induced atelectasis, by re-expanding sections of the lungs that may have been evacuated of air and collapsed.

2.2.2. Preparing the Equipment

Suction Catheter

The catheter size will vary depending on the size of the airway:

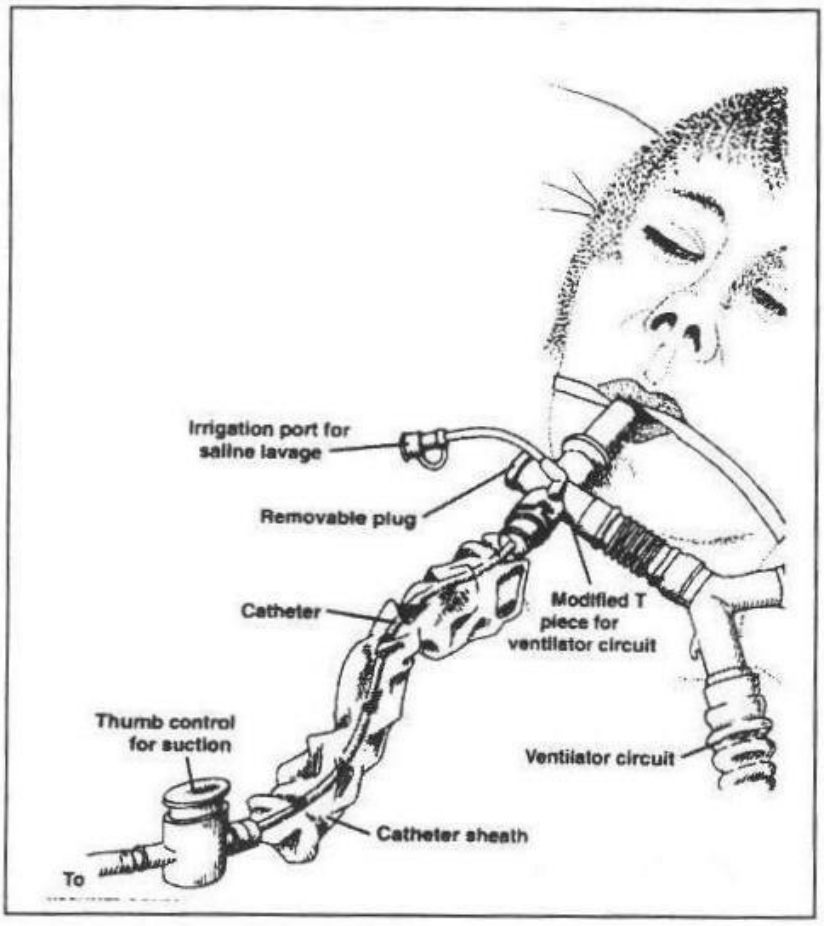
CORRESPONDING SIZES

Shiley Product Size	Inner Diameter	Suction Catheter to Use
PED/NEO 3.0	3.0 mm	5/6 Fr
PED/NEO 3.5	3.5 mm	6 Fr
PED/NEO 4.0	4.0 mm	6 Fr
PED/NEO 4.5	4.5 mm	8 Fr
PED/NEO 5.0	5.0 mm	8 Fr
PED/NEO 5.5	5.5 mm	10 Fr
4 DCT	5.0 mm	8 Fr
6 DCT	6.4 mm	12 Fr
8 DCT	7.6 mm	14 Fr
10 DCT	8.9 mm	16 Fr

The catheter size should be no more than ½ the diameter of the artificial airway. If the airway is fully occluded with the catheter it may cause a drop in $Pa0_2$. In addition, large catheters and small interior diameter of artificial airways, when coupled with higher suction flow rates, produce the greatest negative airway pressures and alveolar collapse/atelectasis. Catheter size can contribute to suction-induced atelectasis, hypoxia, intrapulmonary shunting and decreased lung compliance. The catheter may also stimulate the vagus nerve, resulting in bradycardia and hypotension. Paroxysmal coughing due to catheter irritation increases intrathoracic pressure, decreases venous return and produces transient hypotension and syncope. It also increases intracranial pressure and reduces cerebral blood flow. Cardiac arrhythmias may occur due to decrease in myocardial oxygen supply or increase in oxygen demands in the presence of accompanying tachycardia and elevated blood pressure.

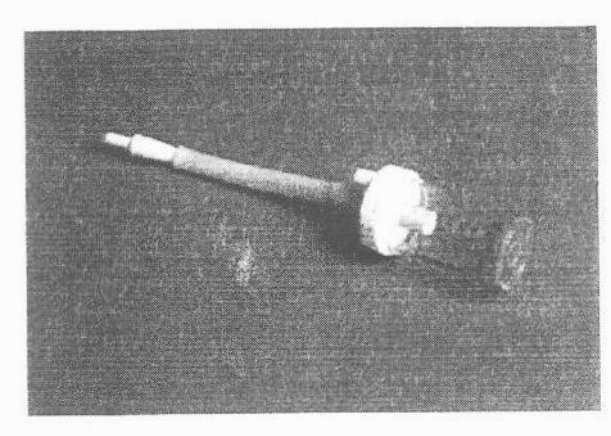
Suction Catheter – Closed System

In ventilated clients, a closed-circuit catheter system eliminates the need to disconnect the patient from the ventilator during suctioning. The severity of arterial oxygen desaturation can be reduced by using a closed system, and unstable clients appear to better tolerate suctioning when not removed from ventilator (Refer to Policy and Procedure: *Suctioning Adult Clients With Artificial Airways #1019* for further information.) The risks of using a closed system include autocontamination, inadequate removal of secretions, and unintentional extubation/decannulation. The benefits include maintenance of oxygen levels & PEEP, decreased hypoxia related complications, staff protection from secretions



Suction Trap

- Used to collect sterile sputum specimens when the patient is unable to expectorate sputum or has an artificial airway in place.
- The sputum trap is placed between the suction catheter and the suction tubing.
- Please see the manufacturer instructions printed on the product packaging for further instructions.



Setting the Suction Pressure

Set suction pressure at:

- 80 – 120 mmHg for adults

Adjust the suction pressure according to the nature of the secretions being removed. Use the lowest suction pressure that will be effective. Thick secretions or mucous plugs may necessitate higher pressures. A practitioner's order is required to increase the pressure above the limits identified above. Damage to the epithelial and mucosal layers of the airways caused by the presence of an artificial airway is magnified with the introduction of a suction catheter. Excessive vacuum causes edema, hemorrhage, and ulceration of tracheal tissue. It can pull air from distal airways, contributes to atelectasis and decreased lung compliance, and has not been found to increase the amount of secretions retrieved.

2.3. Complications of Tracheal Suctioning

	Symptoms	Prevention
▪ Hypoxemia/Hypoxia	▪ Decreased oxygen saturation ($Sa0_2$ < 90% or below patient's baseline) ▪ Cyanosis ▪ Cardiac Dysrrhythmias: tachycardia or bradycardia ▪ Premature ventricular contractions ▪ Cardiorespiratory arrest	▪ Limit suction pressure to: 80 – 120 mmHg for adults ▪ Limit duration of suctioning to 10 – 15 sec. per pass ▪ Avoid catheters larger than ½ the diameter of the airway ▪ Manually ventilate as ordered until pre-suction status resumes ▪ Hyperoxygenate &/or hyperventilate prior to suctioning ▪ Avoid routine suctioning – suction only as needed. ▪ Limit number of catheter passes
▪ Cardiac Dysrrhythmias ▪ Cardiac Arrest/Death	▪ Tachycardia – decreased arterial oxygen content ▪ Bradycardia – vagal response	▪ Assess for hypoxemia ▪ Stop suctioning ▪ Administer oxygen ▪ Manual ventilation as needed

	Symptoms	Prevention
▪ Trauma ▪ Tracheal mucosal damage ▪ Pulmonary Hemorrhage/Bleeding	▪ Aspiration of blood tinged mucous ▪ Decreased air entry	▪ Use lowest level of suction pressure that will be effective ▪ Perform suction procedure gently ▪ Avoid forcing the catheter against resistance ▪ Do not apply suction while inserting the catheter ▪ Withdraw catheter slightly (1 cm) before applying suction ▪ Lubricate suction catheter with sterile Normal Saline ▪ Limit number of catheter passes ▪ Avoid routine suction – suction only as needed
▪ Infection: patient, caregiver	▪ Increased abnormal secretions in the trachea ▪ Colonization with gram-negative organisms ▪ Increased heart rate, respiratory rate and temperature	▪ Use sterile equipment; solutions ▪ Maintain strict aseptic technique ▪ Keep ends of oxygen source clean to reduces possibility of contamination of the oxygen source ▪ Use gentle suctioning technique to avoid trauma ▪ Optimal hydration, nutritional and metabolic status ▪ Avoid routine suctioning – suction only as needed ▪ Wash hands before and after procedure ▪ Provide oral care following the suctioning procedure ▪ For staff protection: use of gloves, masks, goggles is required
▪ Hypotension/hypertension	▪ Significant change from baseline BP	▪ Stop suctioning ▪ Oxygenate and ventilate ▪ Calm manner while suctioning ▪ Pain control

	Symptoms	Prevention
▪ Atelectasis	▪ Decreased air entry ▪ Change in chest x-ray	▪ Limiting amount of negative pressure used (see hypoxia section) ▪ Keep duration of suctioning as short as possible (see hypoxia section) ▪ Provide hyperventilation before and after suctioning ▪ Appropriate size of suction catheter
▪ Vagal Stimulation	▪ Cardiac dysrhythmias; most often bradycardias	▪ Maximize oxygenation before, during and after suctioning procedure ▪ Calmly reassure client during procedure
▪ Bronchoconstriction/ Bronchospasm ▪ Paroxysmal Coughing	▪ Change in air entry ▪ Wheezes auscultated ▪ Same as for hypoxemia	▪ Administer bronchodilators as ordered. May need to do prior to suctioning or give routinely ▪ Ventilate client in “sync” with patient’s respiratory effort ▪ Talk calmly and slowly to client to calm them ▪ May need to sedate/chemically paralyze client if unable to ventilate
▪ Obstruction	▪ Unable to ventilate patient ▪ Unable to suction client	▪ Call for help (Physician, Respiratory Therapist, other staff) stat and prepare to change artificial airway ▪ Continue to attempt to ventilate client until help arrives
▪ Increased Intracranial Pressure	▪ May correspond with increased BP & coughing	▪ May need to give aerosolized lidocaine (Practitioner’s order) 15 minutes before suctioning
▪ Distress/pain	▪ Visual signs of distress/pain ▪ Increased heart rate and respiratory rate	▪ Explain procedure to client in calm/reassuring manner. Include discomfort, shortness of breath and the client’s role in coughing during the procedure

3.0 REFERENCES

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For additional references, see policies in Appendix A.

4.0 APPENDIX A – POLICIES

Saskatoon Health Region	Policies and Procedures Title: **SUCTIONING ADULT CLIENTS WITH ARTIFICIAL AIRWAYS** I.D. Number: **1019**
Authorization: [x] Critical Care Committee [x] SHR Nursing Practice Committee	Source: **Nursing/Respiratory Therapy/ Physiotherapy** Date Revised: November 2014 Date Effective: June 2005 Scope: **SHR & Affiliates**

For the purpose of this policy, client will be used when referring to clients, patients, and residents.

DEFINITIONS:

Artificial Airway – A tube or tube-like device that is inserted through the nose, mouth or into the trachea to:

- Create a route for mechanical ventilation
- Allow easy access of suctioning
- Relieve mechanical airway obstruction
- Protect the airway from aspiration related to impaired cough or gag reflexes

Note: For the purpose of this policy, artificial airways include endotracheal (ET) tubes and tracheostomy tubes.

Endotracheal Tube (ETT) – A type of tracheal tube that is inserted through the mouth (orotracheal) or nose (nasotracheal). Typically an ETT is constructed of polyvinyl chloride. Most ET tubes have an inflatable cuff to seal the trachea and bronchial tree against air leakage and aspiration of gastric contents, blood, secretions, and other fluids.

Tracheostomy Tube – A type of tracheal tube. This 2-3" long curved metal or plastic tube is inserted into the trachea through a surgical incision in the neck or with a percutaneous dilatation technique. Several types of tracheostomy tubes are available, with or without a cuff, for neonatal, pediatric and adult uses.

Fresh Tracheostomy Stoma – Stoma that has not yet had an initial tracheostomy tube change.

Non-Established Tracheostomy Stoma – Stoma that has had an initial uncomplicated tracheostomy tube change (usually done at 7-10 days post-op, but is not yet 14 days post-op).

Established Tracheostomy Stoma – Stoma that is more than 14 days post-op and that has had 2 uncomplicated tracheostomy tube changes.

Open Suctioning Technique – Client is not connected to a ventilator or is temporarily disconnected from the ventilator and is suctioned with a regular suction catheter.

Closed Suctioning Technique – Utilizes an in-line suction catheter with client remaining attached to ventilator and may be recommended for clients with high oxygen requirements or increased levels of positive end-expiratory pressure (PEEP). Closed technique reduces de-recruitment of alveoli and subsequent atelectasis. It also minimizes aerosolization of contaminated secretions and may prevent nosocomial infections.

Qualified Personnel for Suctioning Artificial Airways:

- **For Fresh Tracheostomy Stoma:** Certified Registered Nurse (RN)/Grad Nurse (GN)/Registered Psychiatric Nurse (RPN) who has the knowledge and skill in suctioning artificial airways on targeted units, Registered Nurse (Nurse Practitioner) RN(NP), Registered Respiratory Therapist (RRT), Physiotherapist (PT), Paramedics and Students (RN, RT, PT, EMT) under direct supervision.
- **For Non-Established Stoma:** as above, and certified Licensed Practical Nurse (LPN)/Grad Licensed Practical Nurse (GLPN) who has the knowledge and skill in suctioning artificial airways on targeted units (refer to SHR Nursing Policy & Procedure Manual: Licensed Practical Nurse (LPN) Added Skills (Assigned Functions) #1071).
- **For Established Stoma:** as above.

Authorized Practitioner – Physician, Registered Respiratory Therapist (RRT), Registered Nurse (Nurse Practitioner) RN (NP) who has the knowledge and skill in suctioning artificial airways.

1. PURPOSE

1.1 To promote effective and safe suctioning practices

2. POLICY

2.1 Special Considerations

2.1.1 Nursing staff will notify the Respiratory Therapy department as soon as possible when a client is admitted or transferred to the unit with an artificial airway.

Note: *In sectors where a RRT is not available, nursing staff will notify an authorized practitioner.*

2.1.1.1 In the acute care setting, a RRT will assess clients with an artificial airway at a minimum of once every 24 hours and more often if clinically required.

2.1.1.2 In sectors where a RRT is not available, the client with an artificial airway will be assessed by an authorized practitioner every 24 hours and more often if clinically required.

2.1.2 When planning transfers of clients with tracheostomies to rural, home care, or long-term care, nursing staff will alert the receiving site as soon as possible, so appropriate resources and/or staff training can be determined and put into place. Avoid transfers on weekends and bank days.

2.1.3 Suction only when clinically indicated based on client assessment in order to:

- Maintain patency of the artificial airway by removing secretions or foreign objects from the trachea and artificial airway when the client is unable to expectorate on his/her own.

- Decrease the potential for infection that may result from accumulated secretions.
- Obtain a sputum specimen for diagnostic purposes.

Note: Routine suctioning is contraindicated.

2.1.4 Clients should be encouraged to cough up secretions independently.

2.1.5 Instillation using sterile NS is not recommended.

2.1.6 Secretions will be mobilized through the use of postural drainage, percussion, vibration, or patient ambulation if indicated, prior to suctioning.

2.1.7 For information on tracheostomy care and accidental decannulation, refer to policy # 1184 – Tracheostomy Care – Adult, Pediatric & Neonate

2.2 **Infection Control**

2.2.1 Perform hand hygiene before and after client contact.

2.2.2 Aseptic technique will be used for suctioning artificial airways.

2.2.3 The use of personal protective equipment (PPE) for staff performing suctioning is mandatory. This includes face/eye protection and sterile/non-sterile gloves as appropriate (i.e. open vs. closed technique). The use of other appropriate equipment for standard precautions may be considered (i.e. gown).

2.2.4 Elevate head of bed (HOB) 30-45° unless contraindicated.

2.2.5 All equipment and supplies should be appropriately disposed of or disinfected.

3. **PROCEDURE**

3.1 Assess the client's respiratory status. If necessary, encourage coughing or suction the client to remove secretions.

Note: *Secretions will be mobilized through the use of postural drainage, percussion, vibration, or patient ambulation if indicated, prior to suctioning.*

3.2 Gather supplies that are required at bedside. Refer to Appendix A.

Note: *Use smaller suction catheters whenever possible. Refer to Appendix B for corresponding suction catheter sizes.*

3.3 Explain procedure to client/family and how they may assist as appropriate.

3.4 Administer analgesics, if required, before performing suctioning, especially if tracheostomy is recent.

3.5 Position client in semi-Fowler's or Fowler's position, with neck slightly extended (unless contraindicated).

3.6 Perform hand hygiene and don PPE.

3.7 Check suction equipment to ensure proper set-up and functioning properly.

3.8 Hyperoxygenate clients prior to suctioning if indicated.

3.8.1 Methods of hyperoxygenation include:
- increasing FiO_2 per ventilator for ventilated clients
- use of a manual resuscitation device connected to oxygen flow meter at flush
- increasing the oxygen flow of oxygen device in use
- having the client take 2-3 deep breaths while receiving a higher than normal concentration of oxygen

3.9 Check negative pressure of the suction regulator and set suction as low as possible while still keeping it high enough to clear secretions effectively.

Note: *Appropriate wall suction range for adults is 80-120mmHg.*

Note: *Suction on portable suction units may be pre-set or may need to be adjusted.*

3.10 **Open Suctioning Technique**

3.10.1 Keeping catheter sterile at all times, attach sterile catheter to non-sterile suction tubing.

3.10.2 Don PPE and sterile gloves.

3.10.3 Lubricate catheter and tubing by dipping the tip in sterile normal saline and suctioning a small amount of solution (can be done directly from the bottle – discard bottle after each use).

3.10.4 On inhalation, insert catheter until resistance is met, then withdraw 1 cm.

Note: *Do not apply suction while inserting catheter. Take care to avoid traumatizing the trachea or carina.*

3.10.5 Apply suction while withdrawing and rotating the catheter.

Note: *Limit duration of each suction event to less than 15 seconds.*

Note: *If contamination occurs, change the catheter and sterile gloves before re-suctioning.*

3.10.6 Clear the catheter and connecting tubing with sterile normal saline before reinserting and at the end of the procedure. After completion, remove and discard the suction catheter.

3.11 **Closed Suctioning Technique**

Note: *The closed suctioning technique facilitates continuous mechanical ventilation and oxygenation while suctioning.*

Note: *The catheter is part of the circuit and is changed by RRT with each circuit change and when contaminated.*

3.11.1 Perform hand hygiene, then apply clean gloves and PPE as indicated.

3.11.2 Pick up suction catheter enclosed in plastic sleeve with dominant hand.

3.11.3 On inhalation, insert catheter until resistance is met, then withdraw 1 cm.

Note: *Do not apply suction while inserting catheter. Take care to avoid traumatizing the trachea or carina.*

3.11.4 Apply suction while withdrawing and rotating the catheter.

Note: *Limit duration of each suction event to less than 15 seconds.*

3.11.5 Withdraw catheter completely into plastic sheath so it does not obstruct the airway.

3.11.6 Irrigate the catheter after completion of suctioning or if secretions accumulate. Ensure the catheter is fully retracted out of the airway. Open the cap on the irrigation port and attach a sterile 0.9% saline ampule or syringe with sterile normal saline. Intermittently depress and release the thumb control while squirting saline into the irrigation port until the catheter and chamber are clear. Use caution to ensure irrigation fluid does not enter ETT or tracheostomy tube. After completion, remove and discard the sterile saline ampule or syringe, do not leave attached to the irrigation port.

3.12 **Monitoring**

3.12.1 The following should be monitored before, during and after suctioning procedure:

- Breath sounds
- Oxygen saturation
- Respiratory rate and pattern
- Heart rate and blood pressure, if indicated
- Sputum characteristics
- Cough characteristics
- Intracranial pressure, if indicated and monitoring capabilities available
- Ventilator parameters, if applicable
- Patient response and comfort

3.13 Repeat suctioning procedure until secretions are cleared from the airway and breath sounds are improved.

Note: *Limit catheter passes to the minimum necessary - usually should not exceed two passes.*

3.13.1 Allow adequate time (at least 1 minute) between suction passes for the client to rest and re-oxygenate. Hyperoxygenate the client prior to additional suctioning passes if clinically indicated.

3.14 Properly dispose of suction supplies.

3.15 Remove and discard PPE. Perform hand hygiene.

3.16 Suction canister & tubing if used should be changed q 48 hours and when visibly soiled.

3.17 **Follow-up Care**

3.17.1 If clinically indicated, hyperoxygenate for at least 1 minute following suctioning as described in 3.8.1.

3.17.2 Auscultate chest for improvement and/or changes in breath sounds.

3.17.3 Monitor closely for any adverse reactions and until all physiological parameters have returned to baseline values.

3.17.4 Ensure there are enough supplies available for the next suctioning event. Do not overstock supplies.

3.18 **Oral Care**

3.18.1 Oral cavity should be assessed every shift.

3.18.2 Oral care should be routinely performed per unit specific standards.

3.18.3 Perform hand hygiene and don clean gloves to provide oral care.

3.18.4 Oral care includes:

- Tooth brushing to prevent plaque buildup every 12 hours and as needed.
- Oral cleansing to promote healing and maintain integrity of the oral tissues.
  - Should be done every 2-4 hours in the intubated clients.
- Antiseptic agent for oral swabbing to prevent or reduce bacterial load and colonization per unit specific standards.
- To minimize the risk of aspiration, suctioning of secretions from the back of the oropharynx should be performed every 6 hours, as needed, and prior to deflating the tracheostomy cuff.

  Note: *The oropharynx may be suctioned with a Yankauer tip or the same catheter used for tracheal suctioning, provided the oropharynx is suctioned last.*

- Application of a water-based mouth moisturizer to provide moisture and maintain the integrity of the oral mucosa.

3.18.5 Yankauer suction tip should be changed q 48 hours & when visibly soiled.

3.19 **Documentation and Reporting**

3.19.1 Charting on the Progress Record, Flow Sheet or Ventilator Record, as per unit policy, following the procedure. Include the following specifics:

- Reason for suctioning
- Time of suctioning
- Amount, consistency, color and odor of secretions
- Client response including changes in vital signs
- Client/family education
- If applicable:
  - Hyperoxygenation
  - Instillation of sterile normal saline
  - Specimen sent
  - Any complications and actions taken

3.19.2 Document when oral care has been provided.

3.19.3 Communicate concerns, complications, and/or recommendations to the physician or authorized practitioner and RRT (if applicable) and document in progress notes.

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Appendix A

TRACHEOSTOMY EQUIPMENT & SUPPLIES

Note: Supplies should be available in a readily accessible location. If kept at client's bedside, supplies should be stored in such a way as to avoid contamination (i.e. not within 2 meters of head of client with droplet risk contamination).

- Tracheostomy Insertion Tray (until tracheostomy is established)
- Manual ventilation device or other barrier device, such as a pocket mask
- Oxygen flow meter
- Suction regulator (continuous/tracheal) with collection canister and tubing
- Yankauer suction device (if required for mouth care/oral suctioning)
- Tracheostomy tube obturator (in a plastic bag, taped to the head of the bed)
- Spare tracheostomy tubes (as listed below):
    - Tracheostomy tube of same size and type (i.e. cuffed or uncuffed)
    - Tracheostomy tube one size smaller and type
- 10 ml syringe for inflating/deflating cuff (if tracheostomy is cuffed)
- Clean gloves
- Sterile gloves if tracheostomy is fresh or client is immunocompromised or in critical care
- Facial protection (i.e. mask with attached visor) and other PPE as required
- Humidification supplies (tracheostomy mask, corrugated tubing, humidity bottle, sterile water) OR Humidity filter (heat moisture exchange (HME) attachments)

Supplies for Tracheostomy Care:

- Tracheostomy Care Tray (if non-disposable inner cannula)
- Disposable inner cannulas of appropriate size (if applicable)
- Dressing set (if required)
- Sterile cotton tip applicators
- Sterile 0.9% Sodium Chloride, 15 ml ampoules for stoma cleaning and lubricating inner cannula
- Tracheostomy dressings
- Tracheostomy twill ties or Velcro holders
- Refer to Tracheostomy Care Policy #1184 for tracheostomy care

Supplies for Tracheostomy Suctioning:

- Tracheal suction catheters of appropriate size (see Appendix C for size chart)
- 0.9% Sodium Chloride, sterile 250 ml bottle
- Sterile 0.9% Sodium Chloride, 15 ml ampoules, for instillation if required
- Sterile 0.9% Sodium Chloride, in a syringe or ampoule, for irrigating closed suctioning catheter if applicable
- Sterile gloves and PPE
- Pulse oximetry
- Stethoscope
- Sterile sputum trap for specimen collection if applicable

Appendix B

CORRESPONDING SIZES

Shiley Product Size	Inner Diameter	Suction Catheter to Use
PED/NEO 3.0	3.0 mm	5/6 Fr
PED/NEO 3.5	3.5 mm	6 Fr
PED/NEO 4.0	4.0 mm	6 Fr
PED/NEO 4.5	4.5 mm	8 Fr
PED/NEO 5.0	5.0 mm	8 Fr
PED/NEO 5.5	5.5 mm	10 Fr
4 DCT	5.0 mm	8 Fr
6 DCT	6.4 mm	12 Fr
8 DCT	7.6 mm	14 Fr
10 DCT	8.9 mm	16 Fr

*These are the most commonly used tracheostomy tubes. There are other sizes and types. To determine the correct suction catheter to use, double the inner diameter (ID) and use the next smallest size catheter. Ex: 6.0 mm ID X 2 = 12, next smallest catheter is 10 Fr.

APPENDIX B – Respiratory System – Anatomy and Physiology

The respiratory system allows the exchange of carbon dioxide, produced by cellular metabolism, and life sustaining oxygen. Interference with the functioning of this system may rapidly result in death.

Respiratory function is regulated by a center located in the brainstem, which detects blood gas concentrations of oxygen and carbon dioxide, and adjusts the respiratory rate and depth to maintain homeostasis.

The respiratory system consists of a network of airways that provide the pathway for the transport and exchange of oxygen and carbon dioxide. The respiratory system is divided into the upper and lower airways.

Upper Airway

- Consists of the nose, pharynx, larynx and epiglottis
- Major functions of the upper airway are:
  - Conducting air to the lower airway
  - Protecting the lower airway from foreign matter
  - Warming, filtering and humidifying inspired air

During inspiration, air enters through the **nose** where the nasal cilia filter out impurities such as small foreign particles (dust, bacteria, some viruses).

From the nose, the air passes into the **pharynx**. The pharynx is subdivided into the nasopharynx, the oropharynx and the laryngopharynx. These serve as “hallways” for the respiratory and digestive tracts. They also play an important role in phonation.

The **larynx** is the upper portion of the trachea and connects the upper and lower airways. It is composed of rings of cartilage, connected by membranes and muscle. One cartilage forms a complete ring and is called the cricoid cartilage, located just below the thyroid cartilage. The vocal cords lie inside the thyroid cartilage. The epiglottis, a flexible cartilage attached to the thyroid cartilage, functions to prevent the entry of foreign material into the airway when a person swallows. The function of the larynx is voice production.

Lower Airway

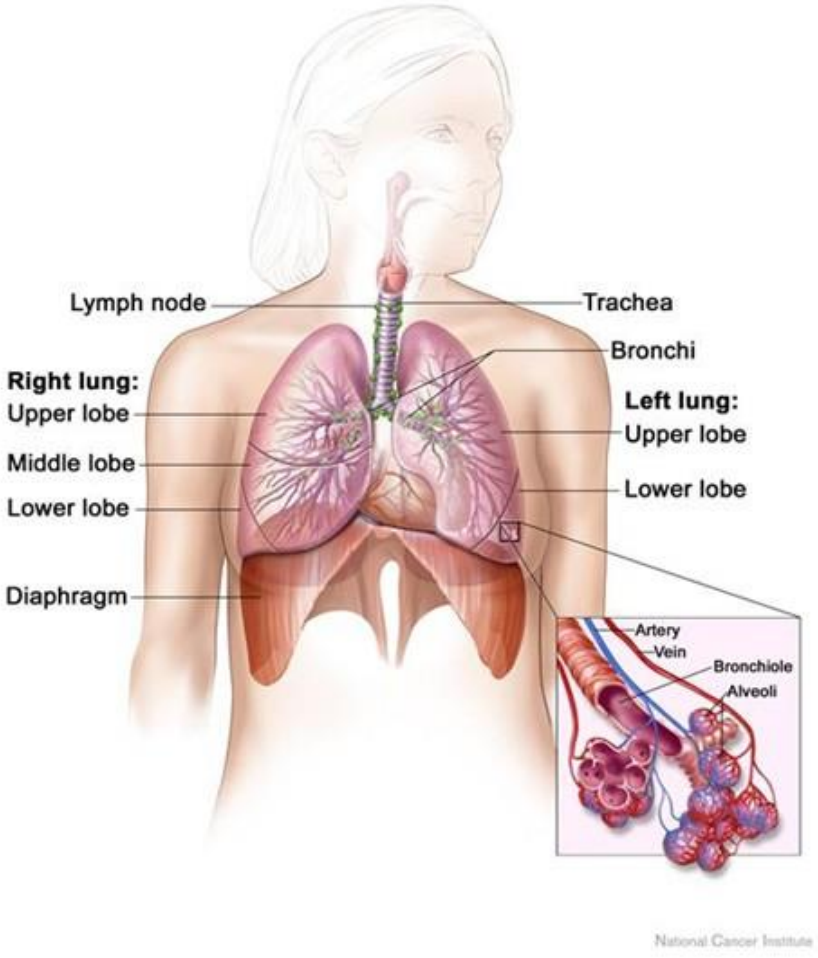
Also called the tracheobronchial tree, the lower airway consists of the tracheal, right and left mainstream bronchi, segmental bronchi, subsegmental bronchi, and terminal bronchioles. The major functions of the lower airway are:

- Conduction of air through the many branches of the airways to the alveolar level
- Provision of the functional mechanism for gas exchange

The **trachea** extends from the larynx to the mainstem bronchi and serves as a passage to and from the lungs. Smooth muscle and C-shaped rings of cartilage protect the trachea and prevent its collapse.
At its lower end, the trachea divides into the right and left mainstem **bronchi**. This bifurcation point is called the carina. One mainstem bronchus enters each lung. The right bronchus is shorter and wider and extends downward more vertically than the

left. Therefore, aspiration occurs more frequently into the right mainstem bronchus. The bronchi are composed of cartilaginous rings and ciliated mucous lining which cleanses the tract by carrying foreign material upward in a blanket of mucous for expectoration or swallowing.

The mainstem bronchi subdivide in an inverted tree-like formation, branching through each lung field. The **bronchioles** are the smallest subdivisions of bronchi. The bronchioles subdivide further, eventually terminating in microsopic alveolar ducts and alveolar sacs called **alveoli**. The walls of these alveoli consist of a single layer of tissue and are the structures that allow the exchange of oxygen and carbon dioxide.



Taken from Wikipedia

Lungs and Accessory Structures

The lungs are located within the thoracic cavity on either side of the heart and extend from the diaphragm to just above the clavicles. The lungs inflate with inspiration and deflate with expiration.

The mainstem bronchus, pulmonary blood vessels and nerves enter the lungs at the hilum, the depression in the medial surface of the lung. The lungs are fully moveable within the thoracic cavity, except at the hilum (at the level of the 4^{th} & 5^{th} vertebrae) where they are anchored by connective tissue and pulmonary ligaments.

Each lung is divided into lobes. The right lung has three lobes and the left lung has two lobes. The lobes of the lung are divided into segments. Blood is supplied by the pulmonary and bronchial arteries.

The lungs are totally enclosed on their outer surfaces by the pleura, a two-layered membrane. The layer lining the chest wall is called the parietal pleura and the layer covering the surface of the lung is the visceral pleura. The two layers of pleura are continuous with one another and form a closed sac. Normally, there is no space between them, but rather a potential space called the pleural space. A thin film of serous fluid lubricates the pleural surfaces to slide smoothly against each other, and creates a cohesive force that causes the lungs to move synchronously with the chest during respiration.

The thoracic cavity is the area within the chest wall bounded below by the diaphragm, above by the scalene muscles, and circumferentially by the ribs, intercostal muscles, vertebra, and sternum. The thoracic cavity has four subdivisions:

- The right pulmonary space, which contains the right lung
- The left pulmonary space, containing the left lung
- The pericardial space, which contains the heart and pericardial sac
- The mediastinal space, located at the center of the thoracic cavity between the two pulmonary spaces, and containing the esophagus, trachea, heart, and great blood vessels

The **diaphragm** is the major muscle of ventilation. Relaxed, it forms a dome shape beneath the lungs. When contracted, it pulls downward, expanding the thoracic cavity and creating an increased negative pressure, which pulls air into the lungs. When it relaxes back into its dome shape, air is forced out of the lungs.

The **thorax** also plays a role in ventilation. The elliptical shape formed by the ribs and the angle of their attachment to the spine causes the thorax to expand when the chest is raised (diaphragm contracting) and become smaller when it is lowered (diaphragm relaxing).

Mechanism of Ventilation

Ventilation is the movement of air in and out of the lungs. It occurs in two phases. The movement of air into the lungs, termed **inspiration**, is an active process involving contraction of the diaphragm and intracostal muscles of the thorax. **Expiration**, the movement of air out of the lungs, is normally a passive process, occurring as the diaphragm and intercostal muscles relax. The stimulus to breathe is transmitted to the medulla in the brainstem in response to rising blood $C0_2$ concentration or falling oxygen concentration. The message is then directed down through the vagus nerve to the other central and peripheral mechanisms. As the message to inhale is recognized by the receptors in the chest, the chest cavity enlarges. This occurs by the diaphragm contracting and flattening and the intracostal muscle contracting up and outward. The diaphragm is innervated by the fourth cervical spinal nerve. Individuals with spinal cord injuries at the level of C_4 and higher will be ventilator dependent. Individuals with complete injuries at the level of T_6 require assisted coughing techniques due to lack of diaphragmatic innervation.

Increasing the capacity of the thorax provides space for lung expansion. Pressure changes in the intrapleural space and within the lung combine to pull the lungs open, producing a pressure gradient, which causes air to flow into the lungs from the atmosphere. Inspiration continues until the pressure gradient between the atmospheric air and the air in the lungs is equal. Air flow then ceases and expiration commences as the diaphragm and intracostal muscles relax. The amount of ventilation that occurs is affected and regulated by:

- Respiratory centers in the brain and periphery
- Chemicals in the cerebrospinal fluid
- PaO_2, $PaCO_2$
- pH
- Other factors such as pain, temperature, emotions, and physical activity

Exchange of Gases

The exchange of gases between the air and the blood in the terminal alveolar capillary system is part of the process of respiration. Respiration refers to the exchange of O_2 and CO_2 in the body within the lungs, between the cells and their environment, and in intracellular metabolism.

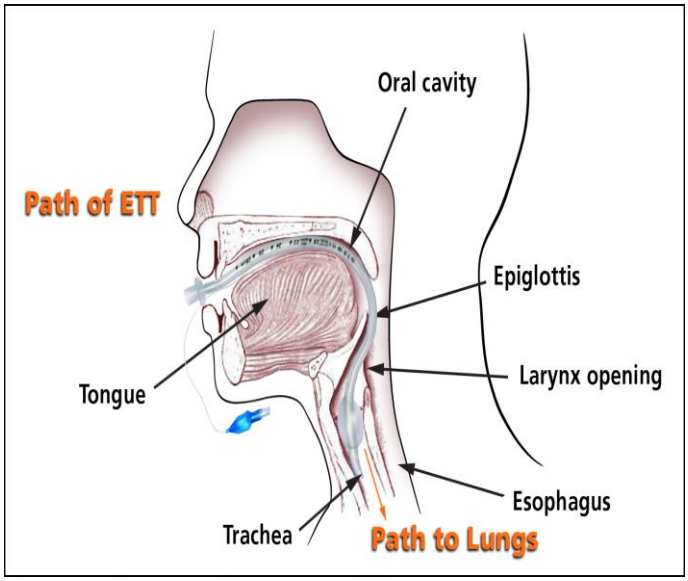
Normal respiration requires:

- Adequate O_2 concentrations in the alveoli
- Adequate amount of haemoglobin capable of binding with O_2
- Diffusion of O_2 from the alveoli in concentrations sufficient to saturate the blood adequately before it leaves the lungs
- Transportation of oxygen to the body cells
- Ability of the body cells to use the O_2 supplied to them

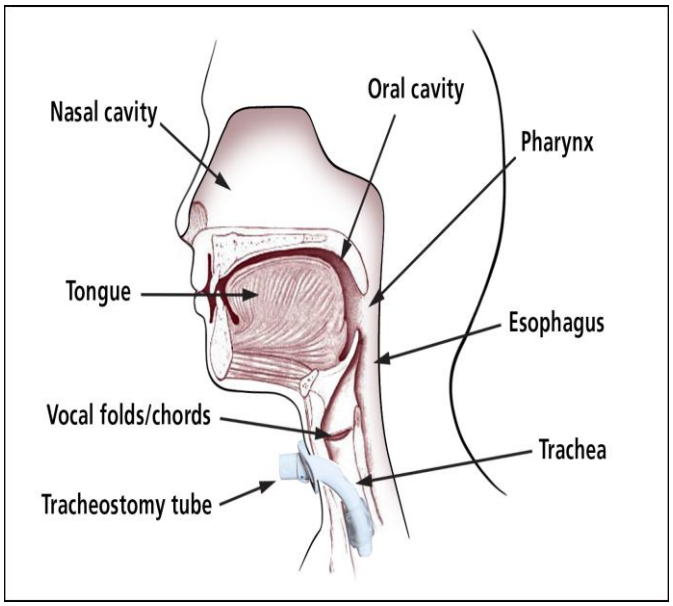
Gas exchange occurs in the pulmonary alveoli and in the tissues. Pulmonary gas exchange is affected by ventilation, perfusion, and diffusion. Gas exchange is also affected by the availability of an adequate concentration of O_2 in the inspired air.

APPENDIX C – ARTIFICIAL AIRWAYS:

Overview of Artificial Airways



Position of Endotracheal Tube
Source: Nursing Reference Center Plus



Position of Tracheostomy Tube
Source: Nursing Reference Center Plus

Artificial airways bypass normal mechanisms to prevent infection. Clients with artificial airways are frequently immunocompromised and susceptible to infection. Since the air is no longer moistened, cilia action is depressed leading to thickened secretions that are difficult to clear. Strength of cough is depressed due to lack of ability to generate increased intrathoracic pressure against a closed glottis. A tracheostomy alters motor and sensory functions responsible for coordinating swallowing, causing increased risk of aspiration.

Endotracheal Tubes

An endotracheal tube is an airway tube inserted into the trachea to ensure patency of the upper airway. It can be inserted through the mouth using an orotracheal tube, or through the nose using a nasotracheal tube. Adult tubes are almost always "cuffed" to prevent leakage, allowing their use with a mechanical ventilator, and decreasing chance of aspiration of oropharyngeal fluid. The cuff is a balloon-like device that circles the lower end of the tube. It is attached to a very narrow tube which connects to the pilot balloon. This device allows for cuff inflation and quick determination of the cuff pressure. Once the cuff is inflated there is not any airflow through the trachea other than that going through the endotracheal tube. The size and depth of tube insertion depends on the size of the client.

Tracheostomy Tubes

Tracheotomy is an incision made into the trachea. A Tracheostomy is the opening or stoma created by a tracheostomy incision. (Tamburi).

The indications for a tracheostomy are:

- Maintain an open functional airway
- Bypass an airway obstruction: tumors, foreign body, larynx or tracheal injury, soft tissue swelling, oral or nasal intubation is not feasible
- Provide protection from aspiration in clients having difficulty clearing their airway due to head injury, CVA, progressive neurological disorders (myasthenia gravis, amolotropic lateral sclerosis)
- Provide mechanical ventilation
- Remove secretions from tracheobronchial tree
- Clients with severe pulmonary disease or pulmonary depression with hypoxia or hypercapnia need supplemental oxygen
- Following prolonged intubation
- Obstructive sleep apnea

Types of Tracheostomy Tubes

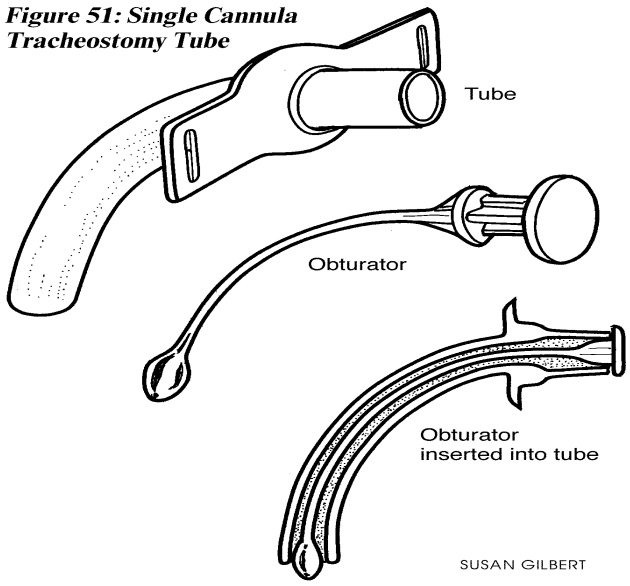
Universal

- Also called the double-lumen or double-cannula tube
- This is the most common type of tracheostomy tube
- It has three parts:
  - Outer cannula – can be either cuffless or with cuff and pilot tube
    - Keeps the airway open
    - ***Cuffed Tube*** – when inflated, this tube seals the airway and prevents the aspiration of oral or gastric secretions. The cuff directs air through but not around the tube. It is commonly used when mechanical ventilation is required or with fresh tracheostomies.
    - ***Cuffless Tube*** – Usually double-lumen tubes, cuffless tubes are used for the long-term management of patients. The clients must have effective cough and gag reflexes to protect themselves from aspiration. Cuffless tubes are used primarily with long term tracheostomy clients.
- Inner cannula – Fits inside the outer cannula and is removed regularly for cleaning if nondisposable, or replacement if disposable.
- Obturator – is used during insertion of the tracheostomy tube. It is removed following insertion and replaced with the inner cannula. Its smooth rounded end makes insertion less traumatic to the tissues.
- Some tracheostomy tubes have extended length distal (before the curve) or proximal (after the curve) eg; Shiley XLT

Universal trach tube - taken from Wikipedia

Single Cannula

- Slightly longer than the universal tube
- It is used for clients who have long or thick necks
- This tube usually requires additional humidification to prevent the accumulation of secretions which could lead to occlusion



http://www.tracheostomy.com/images/drawings/tube.gif

Fenestrated

- These tubes have an opening on the posterior wall of the outer cannula, which allows air to flow through the upper airway and tracheosotomy opening.
- This air movement allows the patient to speak and produce a more effective cough. The fenestrated tube is often used during weaning to ensure that clients can tolerate breathing through the natural airway before tube removal.
- It carries the significant risk of tissue overgrowth of the fenestrations and subsequent tissue trauma upon removal if left in place too long.

Tracheostomy Tubes. *CINAHL Nursing Guide* [serial online]. July 4, 2014;Available from: Nursing Reference Center Plus, Ipswich, MA. Accessed April 21, 2016

Decannulation Plug

- It attaches to the outer cannula after the inner cannula has been removed to block air flow through the tracheostomy tube and directs breathing through the mouth and nose
- To be used only on cuffless tracheostomy tubes or when the cuff is totally deflated
  - Cuffed trachostomy tubes must be totally deflated before decannulation plug is put on
- Designed to facilitate tracheostomy tube weaning and voice restoration
- It is a universal size – will fit any tracheostomy tube
- Can be difficult to put on (client coughing)
- Can be scary the first time for the client
- May have a lot of secretions at first (due to deflation of cuff)
- Can eat with plug in place – assess swallow first
- Deliver oxygen via nasal prongs or mask
- When not in use – store in sterile container
- Clean with soap & water, rinse thoroughly

5.0 REVIEW QUESTIONS

NAME: _____ DATE: _____

1. Choose three reasons for suctioning an artificial airway:
   a) Dyspnea, tachypnea, apnea
   b) It is it is done every 4 hours
   c) You visualize sputum on the outside of the artificial airway
   d) Noisy respirations /abnormal breath sounds or decreased breath sounds
   e) Deterioration in client's color, cool skin

2. Answer True (T) or False (F) to the following questions:
   1) Tracheostomy/ETT suctioning is painless, causing no anxiety to the patient. ❑ True ❑ False
   2) Routine suctioning should be avoided. ❑ True ❑ False
   3) Suctioning is effective only for exudate in the upper airways. ❑ True ❑ False
   4) The patient should be positioned at 30^{o} upright if possible during suctioning ❑ True ❑ False
   5) The suction apparatus may be set at any pressure depending on the viscosity of the secretions. ❑ True ❑ False
   6) Sterile normal saline is routinely instilled prior to each suctioning episode to help loosen secretions. ❑ True ❑ False
   7) Humidification of inspired air and systemic hydration assist to keep secretions thin and easier to move. ❑ True ❑ False

3. Choose three signs that suctioning has been effective:
   a) The client appears less restless & agitated or LOC improves
   b) The client starts using accessory muscles for breathing
   c) Improvement in SpO2
   d) The client has a regular breathing pattern
   e) You hear gurgles/crackles or wheezes on auscultation of the client's breath sounds

4. Answer True (T) or False (F) to the following questions:
   1) The risk of hypoxemia can be reduced by using suction pressure over 120 mmHg. ❑ True ❑ False
   2) Suctioning longer than 10 seconds may cause cardiac arrhythmias. ❑ True ❑ False
   3) Aspiration of blood tinged mucous is not a sign of mucosal damage. ❑ True ❑ False
   4) Prior to performing closed suctioning it is not necessary to perform hand hygiene. ❑ True ❑ False
   5) Keep the duration of suctioning short as possible to decrease the risk of developing atelectasis. ❑ True ❑ False
   6) Hyperoxygenation is performed before, during, and after suctioning depending on the client's respiratory status. ❑ True ❑ False