Oxygenation and Respiratory Nursing

Hypoxia signs, oxygen devices and SpO_2 targets, lung expansion, suctioning, tracheostomy and chest tube care, and ABGs in four steps

HYPOXIA: EARLY VS LATE

Open RN 11.2 and 22.2. SpO_2 falling below 90% with these signs suggests respiratory failure.

STAGE	SIGNS
Early	Restlessness, anxiety, new confusion; tachycardia (over 100); tachypnea (over 20)
Distress	Dyspnea, can't finish sentences, accessory muscles, noisy breathing, nasal flaring (infants), sits up or leans forward, can't lie flat
Late	Cyanosis (lips, oral mucosa; bluish or gray skin), falling level of consciousness, falling SpO_2 and worsening vital signs
Chronic	Clubbing of the fingertips

- Hypercapnia ($PaCO_2$ over 45): headache, dizziness, flushed skin, confusion, then drowsiness. In chronic COPD it may cause few symptoms.
- Pulse oximetry misleads with severe anemia or poor peripheral circulation; an ABG gives the true PaO_2.

EXAM TIP New restlessness or confusion in a client with lung disease is hypoxia until proven otherwise: assess airway and SpO_2 before giving a sedative.

OXYGEN DEVICES AND WHEN TO CHOOSE EACH

Open RN 11.3 and BTS 2017. Open RN sets the simple mask at 6–10 L/min.

DEVICE	FLOW	FIO_2 (APPROX.)	CHOOSE IT FOR
Nasal cannula	1–6 L/min	24–44% (~4% per L)	Stable clients, low needs; can eat and talk
Simple mask	5–10 L/min	35–50%	Moderate needs; never below 5 L/min
Nonrebreather (reservoir) mask	10–15 L/min	60–80%	SpO_2 below 85% or critical illness
Venturi mask	Set by adaptor	24–60%, precise	Hypercapnia risk (COPD) needing an exact FiO_2
High-flow nasal cannula	Up to 60 L/min	Up to 100%, heated, humidified	Acute failure; alternative to a reservoir mask; RT sets up
Bag-valve mask	15 L/min	Near 100%	Apnea or inadequate breathing; preoxygenation

- Fill the reservoir bag before applying a nonrebreather; it should never fully collapse. Too little flow on a simple mask lets the client rebreathe CO_2.
- Humidify a cannula above 4 L/min (AARC, Open RN). Pad tubing over the ears; water-based lubricant only.
- Oxygen is a medication: in an emergency start it per protocol, then call the provider or rapid response.

SpO_2 TARGETS AND COPD

CLIENT	TARGET SpO_2	STARTING DEVICE (BTS)
Most acutely ill adults	94–98%	Cannula 2–6 L/min or simple mask 5–10 L/min
SpO_2 under 85% or critically ill	94–98%	Reservoir mask 15 L/min, then step down
COPD or other hypercapnia risk	88–92%	24% Venturi 2–3 L/min, 28% Venturi 4 L/min, or cannula 1–2 L/min

- Hypercapnia risk: COPD, morbid obesity, cystic fibrosis, chest wall deformity, neuromuscular disease.
- Check a blood gas; if pH and $PaCO_2$ are normal and there is no history of NIV or intubation, the target can move to 94–98% (BTS).
- Oxygen treats low saturation, not breathlessness. Wean once stable; stop when SpO_2 stays in range on room air.

SAFETY Never withhold oxygen from a hypoxic COPD client: titrate to 88–92%, and never remove it just to get a room-air reading.

POSITIONING, LUNG EXPANSION AND AIRWAY CLEARANCE

- Dyspnea: high Fowler; a client with COPD may lean forward on the overbed table (tripod).
- Incentive spirometer: sit upright, inhale slowly and deeply to raise the piston, hold 5 seconds, rest; 10 times an hour while awake. Pair with deep breathing, coughing, walking, pain control.
- Cough and deep breathe 3–5 times an hour; splint an incision with a pillow. Huff cough (medium breath, quick 'ha') if coughing is hard.
- Pursed-lip breathing: in through the nose, slow out through pursed lips; reduces air trapping in COPD.
- Vibratory PEP (flutter, Acapella) needs an order; sit up, deep breath, blow out, then cough.
- Space activities and give pain relief; watch for oversedation from opioids.

EXAM TIP IS can be delegated to assistive personnel; the RN monitors the volume reached and how often.

SUCTIONING SAFETY

- Suction when indicated: secretions seen in the airway or heard on auscultation. Conscious: semi-Fowler. Unconscious: side-lying facing you.
- Artificial airway: sterile technique; catheter no wider than half the tube's inner diameter.
- Preoxygenate with 100% oxygen (30–60 s) or deep breaths. Insert without suction; suction only while withdrawing, rotating.
- 15 seconds or less per pass; let SpO_2 recover between passes; no more than 2 passes, then call for help if no better.
- Adult wall suction: 100–150 mm Hg, no higher than 150 (Open RN); AARC 2022 outer limit –200 mm Hg, lowest pressure that clears secretions. Shallow first; deep only if shallow fails. Avoid routine saline instillation.

SAFETY Stop suctioning for bradycardia, a new dysrhythmia or falling SpO_2, reoxygenate, and call for help. Never suction through a fenestrated tube without a nonfenestrated inner cannula.

TRACHEOSTOMY CARE AND DISLODGEMENT

- At the bedside: obturator, spare tubes (same size and one smaller), syringe for the cuff, lubricant, ties, bag-valve mask, suction.
- Care: sterile; clean or replace the inner cannula; clean the stoma from the top down, a fresh swab for each stroke; split gauze dressing; watch for redness or drainage.
- Change ties with two people, one holding the tube; one finger should fit under the tie.
- Most clients cannot speak with a trach: give a whiteboard or other way to communicate.

1. Call for airway help. Look, listen and feel at both the mouth and the stoma; not breathing: call the code team, CPR if no pulse.
2. Give high-flow oxygen to the face and the stoma.
3. Remove any speaking valve or cap and the inner cannula; try to pass a suction catheter.
4. Catheter will not pass: deflate the cuff. Still not improving: remove the trach tube.
5. Still in trouble: reapply oxygen to face and stoma; bag by mouth with the stoma covered, or apply a small mask to the stoma (laryngectomy: stoma only).

SAFETY Do not bag hard through a tube that may be displaced: air forced into the neck makes rescue harder. A mature tract (about 7 to 10 days, or after the first tube change) can be recannulated with the same size or one smaller by a trained clinician, per policy, using the obturator; never blindly reinsert into a fresh tract (false-passage risk): oxygenate and wait for airway help.

CHEST TUBE NURSING CARE

Open RN Advanced Skills 6.2–6.4; Roebker 2023.

CHECK	EXPECTED	ACT IF
Drainage unit	Upright, below the chest, no kinks or dependent loops	Tipped over: check water levels, replace if needed
Water seal	Water at 2 cm; tidaling with breathing	No tidaling: kink or clot, or the lung has re-expanded
Water seal bubbling	Intermittent on exhale or cough with a pneumothorax: a small air leak, expected early, should fade; document and trend	Continuous, a new or increasing leak, or after the lung has re-expanded: check connections, then notify
Suction chamber	Wet: gentle bubbling at –20 cm; dry: indicator showing	No bubbling: check suction source; vigorous: too high
Drainage	Level marked with date and time; amount and color charted	Over 200 mL/h sustained (Open RN: averaging that for 4 h), cloudy, or stops suddenly in the first 24 h
Client	Stable SpO_2, breath sounds, site dry	New crepitus, tracheal shift, SpO_2 under 90%: call now

- Keep at bedside: two rubber-tipped clamps, a container of sterile water or saline, sterile or petroleum gauze and tape.
- Do not strip the tubing or clamp routinely (risk of tension pneumothorax). Transport off suction, unclamped.
- Disconnected: put the tube end in sterile water (or clamp briefly near the chest), then reconnect or replace the system per policy and release any clamp.
- Tube pulled out: cover the site at once with a sterile occlusive dressing taped on three sides; stay with the client and call the provider.

EXAM TIP Sudden dyspnea, hypotension, tachycardia and a tracheal shift with a chest tube: suspect tension pneumothorax and call the rapid response team.

ABGS IN FOUR STEPS

VALUE	NORMAL	ACID SIDE	BASE SIDE
pH	7.35–7.45	Below 7.35	Above 7.45
$PaCO_2$ (lungs)	35–45 mm Hg	Above 45	Below 35
HCO_3^- (kidneys)	22–26 mEq/L	Below 22	Above 26

1. pH: acidosis or alkalosis?
2. $PaCO_2$ moves opposite to pH: respiratory problem.
3. HCO_3^- moves the same way as pH: metabolic problem (ROME: respiratory opposite, metabolic equal).
4. Compensation: other value still normal = uncompensated; both abnormal with abnormal pH = partial; pH back in range = full.

- Respiratory acidosis: COPD, asthma attack, pulmonary edema, opioids or sedatives, anesthesia.
- Respiratory alkalosis: hyperventilation (anxiety, pain, fear, early PE or asthma, early salicylate overdose).
- Metabolic acidosis: DKA, lactic acidosis, severe diarrhea, kidney failure.
- Metabolic alkalosis: vomiting, NG suction, diuretics, hypokalemia, bicarbonate given.

Sources (19) are listed with links at rnbasics.com/sheets/oxygenation-respiratory.html. For education and exam preparation only. Not medical advice; follow current guidelines and your institution's protocols. RN Basics is an independent study aid not affiliated with any certifying body.