VOLUME 1 · CHAPTER 22 · PART 2

Basic Airway Management and Ventilation

Positioning, oxygenation, manual maneuvers, adjuncts, and ventilation

Everything achievable without a laryngoscope — and the reason most airways never need one.
Aligned to Region SOPs

SESSION PLAN

35 minutes, five blocks, in order of increasing cost

5 Proper positioning

Ear to sternal notch. Free, no complications, and it makes every subsequent step easier or harder.

10 Oxygenation

Supply and regulation, the delivery devices, CPAP and BiPAP, PEEP, and high-flow nasal cannula.

5 Manual maneuvers

Head-tilt/chin-lift and jaw thrust — the two ways to move a tongue with your hands.

5 Basic adjuncts

Nasopharyngeal and oropharyngeal airways: how to size them, how to place them, and who gets which.

10 Ventilation

Mouth-to-mask, bag-valve mask, the rule of threes, and what changed about cricoid pressure.

The order is the argument

Positioning is free and has no complications. Oxygen is nearly free. A manual maneuver costs you a set of hands. An adjunct is a foreign body in an airway. Positive pressure ventilation overrides a physiologic safety mechanism and inflates a stomach.

You climb only as far as you have to, and you stop climbing the moment the patient is adequately oxygenated and ventilated.

Carried forward from Part 1 — the two questions that decide everything today

Is this patient OXYGENATING? Is this patient VENTILATING? Every intervention in this session answers exactly one of those two questions, and knowing which one it answers is the entire skill. A nonrebreather answers the first and does nothing at all for the second.

OPENING PROBLEM

Five minutes in, and it is not working

The scene

A 58-year-old man, unresponsive after a witnessed opioid overdose. He has a pulse. He is not breathing adequately.

What you can see

He is supine on a mattress. Your partner is kneeling at his head, holding the mask one-handed with a C-grip while squeezing the bag with the other, about 30 times a minute. There is no adjunct in place. The chest is barely moving. His abdomen is becoming visibly distended. SpO_2 is 84% and falling. Nobody has touched the capnography.

Your partner looks up and says: "I think we need to tube him."

Before you answer:

1. Name five things that are wrong here — none of which are fixed by a tube.
2. What would intubation actually solve? And what does it require that you do not currently have?
3. What is the distended abdomen telling you, and what is it doing to the chest?
4. Name one change you could make in the next ten seconds that costs nothing at all.

Proper Positioning

Free, reversible, and with no complications — which makes it the only intervention in this chapter with no downside at all.

Position of comfort · Ear to sternal notch · Sniffing · Ramped

Ear to sternal notch — the alignment everything depends on

Figure 22-39 Ear-to-sternal notch alignment.

Source: Paramedic Care: Principles & Practice, 6th ed. © Pearson Education.

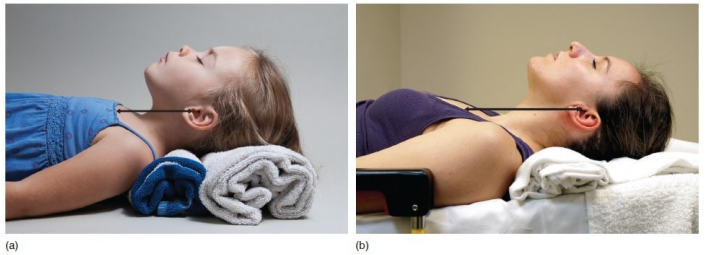

Figure 22-38 Padding to achieve the sniffing position.

Source: Paramedic Care: Principles & Practice, 6th ed. © Pearson Education.

1 Conscious patients: position of comfort

A patient in distress has already found the position that works. Tripoding is a TREATMENT, not a symptom — and forcing them supine can be immediately harmful.

2 Unconscious patients: ear to sternal notch

This brings the oral, pharyngeal and laryngeal axes into approximate alignment — which opens the airway, improves bag-mask ventilation, and creates a line of sight to the glottis if you later need one.

3 Sniffing: flex the neck, EXTEND the head

This is routinely done backwards, as a simple hyperextension of everything. Slight flexion at the neck, extension at the head — assuming no cervical spine injury is suspected.

4 Then look from the side and check

The external auditory meatus should sit level with the sternal notch — two seconds, and the only reliable way to know.

REGION SOP In an adult, padding usually goes under the OCCIPUT. In a child, the large occiput already flexes the head — which is why the pediatric protocol specifies padding under the SHOULDERS. And for preoxygenation in respiratory failure, your SOP calls for the head elevated 30 degrees.

The ramped position — obesity is a positioning problem first

Figure 22-40 The ramped position.

Source: Paramedic Care: Principles & Practice, 6th ed. © Pearson Education.

Three separate problems, only one of which is anatomy

Anatomy — fixed by ramping.
Physiology — reduced FRC and raised demand, not fixable by position.
Equipment — some extraglottic devices cannot generate enough pressure to lift a very heavy chest.

1 Flat makes it worse, not neutral

In a large patient, lying flat drops the chest and shoulders BELOW the head, flexing the neck and pulling the airway axes further out of alignment. A towel under the head compounds it.

2 Elevate the upper body, not the head

Stacked blankets under the shoulders, upper back and head to build a wedge — or simply raise the head of the cot. The target is unchanged: ear level with the sternal notch, checked from the side.

3 This is the highest-value thing you will do

Much of the anatomic difficulty of intubating the morbidly obese can be OVERCOME WITH PROPER POSITIONING. The most useful intervention happens before anyone picks up a device.

4 But positioning cannot fix the physiology

Obesity reduces functional residual capacity while increasing oxygen demand — a smaller tank and a bigger engine. Preoxygenation buys far less time than the same three minutes in a lean patient.

Oxygenation

Supply, devices, and pressure — plus the distinction that decides which of them is the right answer.

Delivery devices · CPAP and BiPAP · PEEP · High-flow nasal cannula

Supply, regulation, and the delivery devices

Device	Flow	Approximate O_2	When you reach for it
Nasal cannula	1–6 L/min	Low to moderate	Comfortable, tolerated for hours, lets the patient talk and drink
Simple face mask	6–10 L/min	Moderate	Moderate requirements; delivered concentration varies with the patient's rate and depth
Partial rebreather	Up to 10 L/min	Moderate to high	When a simple mask has not produced a satisfactory result
Nonrebreather	12–15 L/min	About 80% — not 100%	The highest concentration of any of these devices, with a reservoir and a tight seal
Venturi mask	Varies by setting	Precisely 24 / 28 / 35 / 40%	Rarely placed by EMS. Know it exists and recognise it on a transfer
Small volume nebuliser	6–8 L/min	With 3–5 mL of fluid	The delivery route for every bronchodilator in your respiratory protocols

Supply

Compressed gas or liquid. Delivery is measured in litres of flow per minute — and flow is not the same thing as delivered concentration.

Humidification

Sterile water delivered with the oxygen to keep mucous membranes from drying. Matters on long transports; rarely on short ones.

The number everyone gets wrong

A nonrebreather gives about 80% at 15 L/min with a good seal — not 100%. Learn the real number.

REGION SOP Routine Medical Care: OXYGEN to maintain SpO_2 > 94%. Nasal cannula 2–6 LPM · Non-rebreather 12–15 LPM · Bag-valve mask 15 LPM. Capnography is monitored and recorded BEFORE and DURING oxygen administration — the Part 1 argument, made operational.

OXYGENATION

Positive airway pressure — changing physiology, not numbers

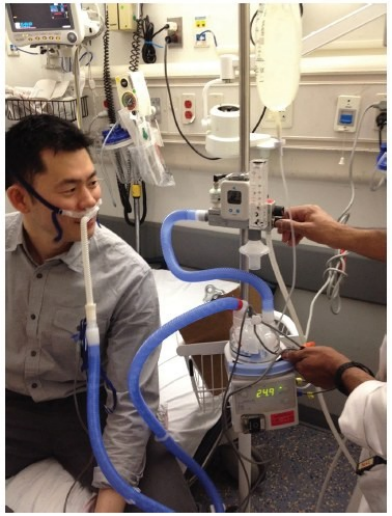

Figure 22-42 Noninvasive positive pressure ventilation.

Source: Paramedic Care: Principles & Practice, 6th ed. © Pearson Education.

1 It recruits alveoli

Holding pressure keeps alveoli open rather than reopening them each breath — the surfactant argument from Part 1, attacking V/Q mismatch directly.

2 It reduces the work of breathing

Splinting the airway open means the patient stops paying the full inspiratory cost of every breath. For a fatiguing patient this is the whole game.

3 And in pulmonary edema, it helps the heart

Raised intrathoracic pressure reduces venous return and left ventricular afterload — a cardiac benefit from a respiratory device.

CPAP vs BiPAP

CPAP holds a STEADY pressure through the whole cycle. BiPAP holds a HIGHER pressure on inhalation and a lower one on exhalation — more comfortable, does more of the work, and less commonly carried.

Contraindications — straight off your own scored sheet

Unconscious or unable to protect the airway or speak · unable to sit up · respiratory arrest or agonal respirations · nausea and vomiting · SBP < 90 · suspected pneumothorax · cardiogenic shock · penetrating chest trauma · facial anomalies, trauma or burns · closed head injury · active upper GI bleeding or recent gastric surgery

REGION SOP CHF / pulmonary edema: CPAP 5 cm PEEP, may increase, max 10 cm. Asthma/COPD severe: DuoNeb delivered THROUGH the CPAP at 5 cm, max 10, DuoNeb may repeat × 2. Skill sheet: max 5 cm for bronchospasm, max 10 for CHF/edema/pneumonia, max 5 pediatric. And if the patient deteriorates on CPAP — REMOVE it and consider an advanced airway.

PEEP valves and high-flow nasal cannula

PEEP — POSITIVE END EXPIRATORY PRESSURE

- **A valve that maintains back pressure in the lungs**
  - It improves oxygenation by RECRUITING MORE ALVEOLI and facilitating gas exchange
- **It lives on the exhalation port of the BVM**
  - Or as a setting on a transport ventilator. Most modern bags have one — go and find it on the bag you have been using all year
- **Same physics as CPAP, applied at a different moment**
  - CPAP holds pressure continuously in a spontaneously breathing patient. PEEP holds it at end expiration in a ventilated one. Both answer the surfactant problem from Part 1
- **But it is not a free win**
  - Raised mean intrathoracic pressure reduces venous return — which can drop the blood pressure of a hypovolemic or shocked patient

HIGH-FLOW NASAL CANNULA

- **40 to 60 litres per minute, through a cannula**
  - Warmed and humidified — which is the only reason those flows are tolerable at all
- **The stated indication: patients who cannot tolerate a mask**
  - CPAP and BiPAP are mask-dependent. The claustrophobic, the agitated, the vomiting, and the patient who simply will not keep a mask on all get nothing from a device they remove
- **What the high flow actually buys you**
  - It washes out nasopharyngeal dead space, delivers a reliably high inspired concentration, and generates a small amount of positive pressure
- **Availability varies — know whether your service carries it**

Coming in Part 3: a nasal cannula left running under the mask during intubation — apneic oxygenation. Same idea, in miniature, at the moment it matters most.

Manual Maneuvers and Basic Adjuncts

Two ways to move a tongue with your hands, and two pieces of plastic that hold it there.

Head-tilt/chin-lift · Jaw thrust · NPA · OPA

Two ways to move a tongue with your hands

1 Head-tilt / chin-lift

The best technique available for the unresponsive patient with NO suspected cervical spine trauma. Supine patient, you at the side of the head. One hand on the forehead with firm downward palm pressure to tilt the head back; two fingers of the other hand under the BONY part of the chin, lifting the jaw anteriorly.

2 Jaw thrust

Acceptable for ANY unresponsive patient who may have a cervical spine injury. Fingers behind the mandibular angles, lifting the jaw forward. Do NOT tilt the head. Thumbs propped on the cheekbones for counterforce.

Both maneuvers do exactly one thing: the tongue is attached to the mandible, so moving the mandible forward pulls the tongue off the posterior pharyngeal wall.

The word that matters is BONY

Fingers under the soft tissue of the chin push the tongue UP into the airway and make the obstruction worse. It is the commonest error in the maneuver, and it is easy to see and fix at a skill station.

Jaw thrust is the one people abandon

It is harder, more tiring, and needs a dedicated pair of hands. But if it is indicated, it is indicated for the whole call — which is an argument for a third provider, not for giving up on it.

These are held, not performed

Your trauma intubation sequence has an assistant perform a jaw thrust immediately before laryngoscopy, and the rule of threes asks for three providers partly so somebody can keep holding one.

REGION SOP Try it before you take the explanation on trust: ventilate a manikin with no maneuver at all, then with one. The change in compliance is immediate, and it makes the argument better than any slide can.

The nasopharyngeal airway

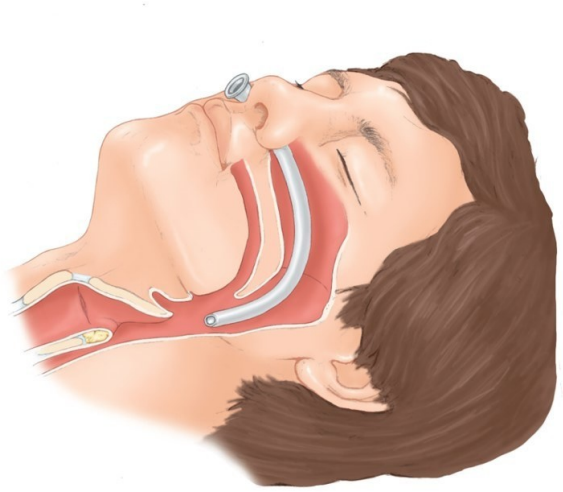

Figure 22-46 Nasopharyngeal airway in place.

Source: Paramedic Care: Principles & Practice, 4th ed. © Pearson Education

1 Prepare

Ensure or maintain effective ventilation with supplemental oxygen. Lubricate the exterior with a WATER-SOLUBLE gel. Select the naris that appears largest.

2 Insert

Push gently up on the tip of the nose. Pass the tube with the BEVEL TOWARD THE SEPTUM, directed straight back along the nasal floor, PARALLEL TO THE MOUTH. Never push against resistance — try the other side.

3 Verify

Noisy breathing resolves and compliance improves during bag-mask ventilation. Feel at the proximal end for airflow on expiration.

4 Then ventilate

Supplemental oxygen or positive pressure ventilation as indicated. The adjunct holds the airway open — it does not do anything else for the patient.

The advantage that defines it

It is TOLERATED WITH A GAG REFLEX, which an OPA is not. So it is the adjunct for the patient who is too awake for an OPA and too obtunded to protect their own airway — the postictal, the still-gagging overdose, the clenched jaw.

Three errors, and why it bleeds

Aiming UPWARD toward the eyebrow instead of straight back along the nasal floor — this is the big one and it causes most of the bleeding. Inadequate lubrication. Forcing past resistance instead of switching sides.

From Part 1: the nasal mucosa's rich blood supply is the same property that warms and humidifies air. Epistaxis in an obtunded patient is an airway problem, not a nuisance.

REGION SOP Do NOT use a nasal airway with significant facial injury or possible basilar skull fracture — written into your head injury protocol. Sizing: nose tip to earlobe, with a diameter approximating the patient's smallest finger.

The oropharyngeal airway

Figure 22-48 Inserting the OPA — curve reversed.

Figure 22-49 Rotated 180° into position.

Source: Paramedic Care: Principles & Practice, 6th ed. © Pearson Education.

1 Clear and prepare

Open the mouth, remove visible obstructions, maintain ventilation with supplemental oxygen. Then grasp the jaw and lift anteriorly.

2 Insert reversed

Hold the airway at its proximal end. Insert with the CURVE REVERSED, tip toward the roof of the mouth.

3 Rotate at the soft palate

Once the tip reaches the soft palate, gently rotate 180° until it rests over the tongue.

4 Verify — then remember what it does not do

Clear breath sounds and chest rise, then oxygen or ventilation as indicated. An adjunct HOLDS the position a manual maneuver created — an OPA with a flexed neck and no jaw thrust is still an obstructed airway.

Why the rotation — and the pediatric exception

Inserting it in its final orientation would drag the tongue BACKWARDS into the pharynx — exactly the obstruction you are relieving. The reversed insertion lets the curve slide over the tongue instead.

In small children the rotation risks damaging the soft palate, so the airway goes in right side up, often over a tongue depressor.

Sizing, and the gating question

Corner of the mouth to the angle of the jaw, or the earlobe. TOO LONG presses the epiglottis down over the glottis; TOO SHORT pushes the tongue back. Both errors give you exactly what no airway at all would.

And the indication is a single question: is there a gag reflex? If there is any gag at all, use a nasal airway instead.

Ventilation

Breathing for someone else — the highest-failure-rate skill in prehospital medicine, and the one nobody practises enough.

Mouth-to-mask · Bag-valve mask · The rule of threes · Pediatric

From your mouth to a bag — and what changed physiologically

Figure 22-50 Pocket mask.

Figure 22-51 Bag-valve mask with reservoir.

Source: Paramedic Care: Principles & Practice, 6th ed. © Pearson Education.

1 Mouth-to-mouth / mouth-to-nose

The most basic techniques — and not used often, because of exposure to body fluids and the absence of supplemental oxygen.

2 Mouth-to-mask

Prevents direct contact with the patient's mouth and expired air. The underrated advantage: BOTH HANDS are on the mask, so the seal is often better than a one-person BVM.

3 Bag-valve mask

The primary method of ventilatory support for apneic or inadequately breathing patients. 10–15 L/min of oxygen — your SOP specifies 15.

Positive pressure ventilation inverts normal physiology — and everything hard about it follows

Normal inspiration is NEGATIVE pressure: the thorax expands, pressure falls below atmospheric, and air is invited in through the path of least resistance — the trachea. Every technique on this slide reverses that. You are pushing air in, and it goes wherever resistance is lowest, which if the airway is not open or you push too hard is the ESOPHAGUS.

Hence: gastric distension is inevitable with prolonged ventilation · barotrauma becomes possible · the stretch receptor safety stop from Part 1 is bypassed entirely · and raised intrathoracic pressure reduces venous return, which in an arrest directly degrades your compressions.

Almost every error in bag-valve ventilation is a version of the same three things: too fast, too hard, or no seal.

One, two, or three providers — and why one is the wrong answer

Figure 22-43 One-person BVM ventilation.

Figure 22-44 Two-person BVM ventilation.

Source: Paramedic Care: Principles & Practice, 6th ed. © Pearson Education.

1 One provider — the hardest way

The one-handed C-grip has to seal the mask, lift the jaw, and hold the head, all at once — which makes it the most difficult version to master.

2 Two providers — the recommendation

One holds a two-handed seal with a jaw thrust; the other squeezes slowly and watches the chest. This is what should GENERALLY be done.

3 Three — when you can get them

Two hands on the mask, one on the bag, and a third for cervical stabilisation, suction, or the adjunct. The rule of threes asks for exactly this.

Why the one-person seal fails invisibly

Under stress, providers press DOWN on the mask to fix a leak. Pressing down flexes the neck and closes the airway — so the harder they try, the worse it gets, and nothing on the mask tells them so. This is the failure in your opening problem.

Two things to change today

Treat two-person BVM as a STAFFING decision, not just a skill — if your options are one-person bagging or asking a fire crew member to hold a mask, ask. Nobody has regretted an extra pair of hands on an airway.

And stop squeezing with a fist. Two fingers and a thumb, or the bag against a thigh, delivers a far more controlled volume.

VENTILATION

The rule of threes — a checklist for when it is not working

3 Providers

Two hands on the mask, one on the bag, one spare for stabilisation, suction, or adjuncts.

3 Inches

Padding to elevate the head into ear-to-sternal notch alignment. The positioning block, applied.

3 Fingers

A proper jaw thrust, held — not a chin pinch, and not abandoned once the adjunct is in.

3 Airways

A nasal airway in EACH nostril, plus an oral airway. Three paths through a pharynx the tongue is occluding.

3 PSI

Gentle pressure, not force. Squeezing harder pushes air into the stomach, not the lungs.

3 Seconds

A slow, deliberate breath. Almost everyone bags too fast, and slowing down fixes four problems at once.

3 PEEP

About 3 cm of positive end expiratory pressure, to recruit and hold alveoli between breaths.

It is a TROUBLESHOOTING checklist, not a setup routine

Employ it whenever bag-valve ventilation is difficult. Its value is that it converts a vague “this is not working” into seven specific, checkable, fixable items — none of which needs new equipment or a new skill. Under stress people do not troubleshoot well, and a list that runs top to bottom rescues that.

Now run it against your opening problem

Flat on a mattress with no padding → three inches. One provider doing two jobs → three providers. No adjunct in place → three airways. Thirty breaths a minute → three seconds. A distending abdomen telling you the pressure is going into the stomach → three PSI.

Five of the seven, all fixable in under a minute, and not one of them requires a laryngoscope.

Cricoid pressure is out. Laryngeal manipulation is in.

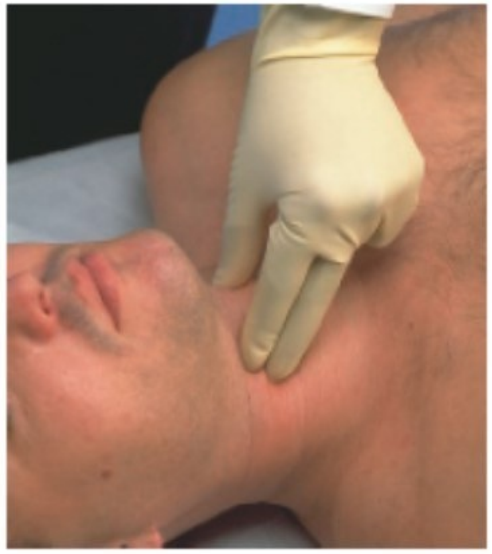

Figure 22-52 External laryngeal manipulation.

Source: Paramedic Care: Principles & Practice, 6th ed. © Pearson Education.

	Cricoid pressure	External laryngeal manipulation
Which cartilage	The CRICOID — the first tracheal ring	The THYROID cartilage
Direction	Pressed posteriorly, toward the spine	Moved LATERALLY, to the patient's left
Intended to	Compress the esophagus and prevent passive regurgitation	Improve the laryngoscopic view of the glottis
Status	NO LONGER RECOMMENDED	Recommended — and listed among the factors that improve first-attempt success
Why	The esophagus is often lateral to the cricoid, so it misses; it worsens the view; it degrades bag-mask ventilation; it can block EGA placement; and the aspiration benefit never materialised	Directed by the person who can actually see the cords — which is what makes it work

BURP — Backwards, Upwards, Rightwards Pressure — is a named, more prescriptive version of the same idea, and one of the listed factors that raise first-attempt intubation success.

How to actually do ELM

The INTUBATOR places their own right hand on the neck and moves the larynx until the view is best — then the assistant takes over and holds exactly that position.

Manipulation directed by the person who cannot see the cords is guesswork.

Ventilating a child

1 Size the equipment first

Bag size depends on the child's age; a Broselow tape determines mask size. Get one in your hands and use it before you need it on a call.

2 Chest rise is the endpoint, not a volume

You cannot size a breath for one child from a bag built for a range of them. A visible rise, no more. Over-inflation distends the stomach almost immediately, and a distended stomach in a small chest materially impairs ventilation.

3 Allow time for exhalation

The same "three seconds" principle from the rule of threes — and it matters more here, because smaller airways and higher rates make breath stacking easier.

4 Then check skin colour and HEART RATE

In children, heart rate is the vital sign that answers to oxygenation. A bradycardic child is a hypoxic child until proven otherwise — and a rising rate is real feedback that you are succeeding.

Children are ventilated roughly twice as fast as adults

Pediatric protocols: 1 breath every 2–3 seconds. Adult drug-assisted intubation: 1 breath every 6 seconds — 10 per minute. Applying the adult rate to a child underventilates a patient with a far higher metabolic rate and far less reserve.

REGION SOP Pediatric: BVM on 100% OXYGEN with airway adjuncts AND PADDING UNDER THE SHOULDERS, 1 breath every 2–3 seconds — the padding instruction traces straight back to the large occiput from Part 1.

SUMMARY

What to carry out of Part 2

1 Climb the ladder in order

Position, oxygenate, open with your hands, hold it with plastic, then breathe for them. Increasing cost, increasing risk — and you stop climbing the moment the patient is adequately oxygenated and ventilated.

2 Positioning is free and it is first

Ear to sternal notch, checked from the side. Padding under the occiput in adults, under the shoulders in children, and a full ramp in the obese.

3 More oxygen or more pressure?

Flow devices raise the inspired concentration. CPAP recruits alveoli and cuts the work of breathing. A patient who needs the second will not be rescued by the first.

4 Adjuncts hold, they do not open

The gag reflex decides which one: no gag, an OPA; any gag, an NPA. And neither replaces the jaw thrust that created the position they are holding.

5 Positive pressure is an inversion

Normal inspiration is negative pressure. Everything hard about ventilation — gastric distension, barotrauma, reduced venous return — follows from reversing that.

6 When it fails, run the rule of threes

Providers, inches, fingers, airways, PSI, seconds, PEEP. Seven checkable items, none needing new equipment — and the answer is almost never a more advanced device.

Without the basic maneuvers, the advanced procedures are worthless.

Part 3 begins exactly where today ends: your Drug Assisted Intubation protocol only opens once two-person BVM WITH ADJUNCTS has proven ineffective or inappropriate. Everything in this session is the precondition for everything in the next one.

REVIEW

Check your understanding

1. What position do you maintain a CONSCIOUS medical patient in, and why is laying them down potentially harmful?
2. Describe the sniffing position precisely — which joint flexes, which extends — and how you check that you have it.
3. Where does padding go in an adult? In a child? And what anatomic fact explains the difference?
4. Why does a large patient need the whole upper body elevated rather than just the head?
5. What oxygen concentration does a nonrebreather actually deliver at 15 L/min?
6. Give the three mechanisms by which CPAP helps, and your protocol's starting and maximum pressures.
7. Your patient deteriorates while on CPAP. What does your protocol tell you to do?
8. In a chin-lift, exactly where do the fingers go — and what happens if they go elsewhere?
9. What single finding decides between an OPA and an NPA, and why does it matter that much?
10. Why is the OPA inserted with its curve reversed, and what is different in a small child?
11. Explain why a one-person mask seal tends to fail invisibly and gets worse the harder the provider tries.
12. List the seven components of the rule of threes, and state when it should be used.
13. Distinguish cricoid pressure from external laryngeal manipulation on four points, including current status.
14. State the pediatric ventilation rate from your SOP, the adult rate, and the bedside endpoint for both.

Answer these before the session and again after — that gap is the measure of what you learned today.