Chapter

1

Cardiac Arrest

Cardiac arrest refers to the sudden cessation of cardiac activity with hemodynamic collapse. Usually within few seconds of cardiac arrest respiration stops. Occasional gasps may be seen. In primary respiratory arrest or apnea, heart continues to beat for few minutes.

Diagnosis

a. Unresponsive patient
b. Cyanosis
c. Absent breath sounds
d. Absent heart sounds
e. Absent pulse in carotids
f. No breathing or occasional irregular gasps
g. BP not recordable

Golden Rules

- Prompt recognition (each second matters).
- Initiation of cardiopulmonary resuscitation (CPR), and
- Early defibrillation.

Basic CPR—without drug/equipment is also called basic life support (BLS)
Advanced CPR/ACLS (advanced cardiovascular life support)—with equipment/drugs.
For unresponsive, pulseless patient, apply basic resuscitation concepts of **CAB:**

C—Circulation
A—Airway
B—Breathing

Resuscitation should be done by a team, with a team leader who allocates roles to each member. The latest AHA (American Heart Association) 2015 guidelines for advanced cardiovascular life support (ACLS) are:

1. **Recognition of cardiac arrest**
   - Check for unresponsiveness
   - Assess scene safety
   - No breathing or only gasping
   - No definite pulse felt within 10 seconds
   - Call for help

2. **Start CPR** (cardiopulmonary resuscitation)
   - Put hardboard under patient's chest
   - Push hard (at least 5 cm) and fast (100 to 120/min)
   - Allow for complete chest recoil in between chest compressions. Minimize interruption between compressions.
   - Rotate compressions every 2 minutes or sooner, between rescuers
   - Attach monitors—defibrillator with ECG leads and pulse oximetry probe to measure saturation
3. **Airway and breathing**
   - Open patients' mouth and clear the throat of food particle, foreign bodies or vomitus
   - Do a throat suction if secretions present
   - Maintain chin lift position
   - Extend the patient's neck
   - Start high flow oxygen connected to ambu bag
   - Bag and mask ventilation should be started. Extend the neck of the patient. Mask must be tightly fitted over the nose and mouth. Then place the fingers of one hand in the C and E position to secure a seal with the mask over the face as shown in Fig. 1.1. Compress the bag with the other hand.

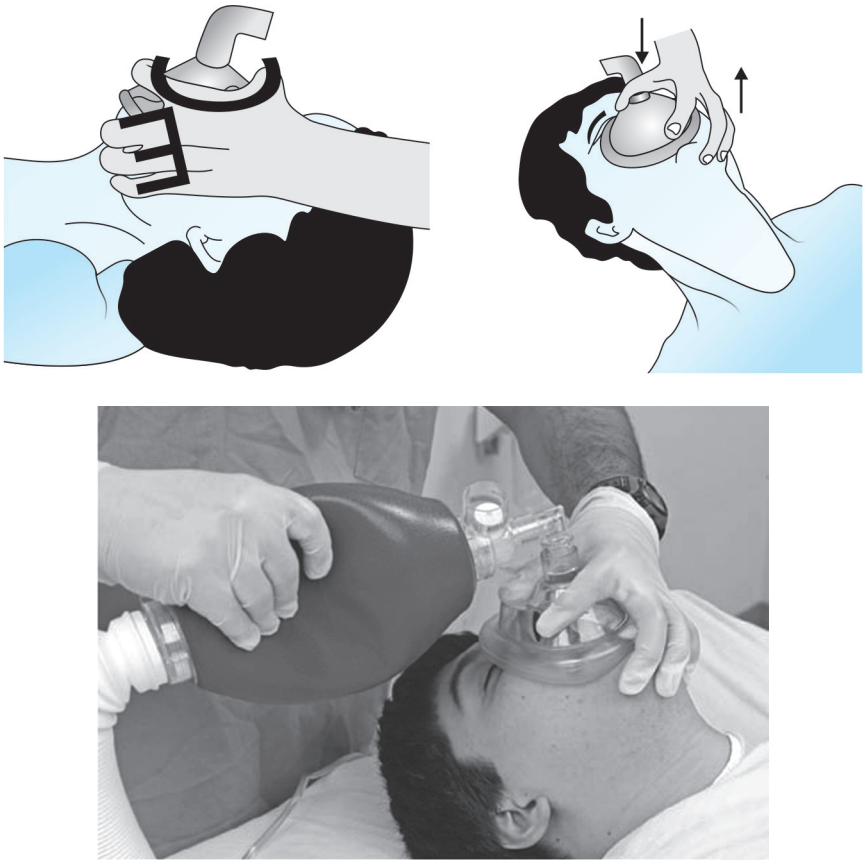


Fig. 1.1

- Breaths to be given in 30:2 ratio—2 breaths every 30 compressions
- Once the equipment is ready (direct laryngoscopy, endotracheal tube (ET) and airway suctioning apparatus) airway is secured with intubation
- Once the airway is secure, confirm the position of ET using waveform capnography. If unavailable, 5-point auscultation can be done. This includes listening for breath sounds over bilateral infraclavicular, axilla and epigastrium on auscultation. Breath sounds should not be heard over the epigastrium, while breath sounds should be heard equally in other areas.
- Once an advanced airway is in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions.
- Connect the patient to mechanical ventilation (if available)

4. Analyze cardiac rhythm

- If VF or pulseless VT, shock should be administered immediately
- Initial dose of 120 to 200 J can be given
- Place one paddle along the right border of the sternum and the other on the left mid axillary line
- Rhythm should be reanalyzed after every 2 minutes, while chest compressions and ventilation continues
- Based on the rhythm, additional shocks to be given (max 200 J)

5. Drugs

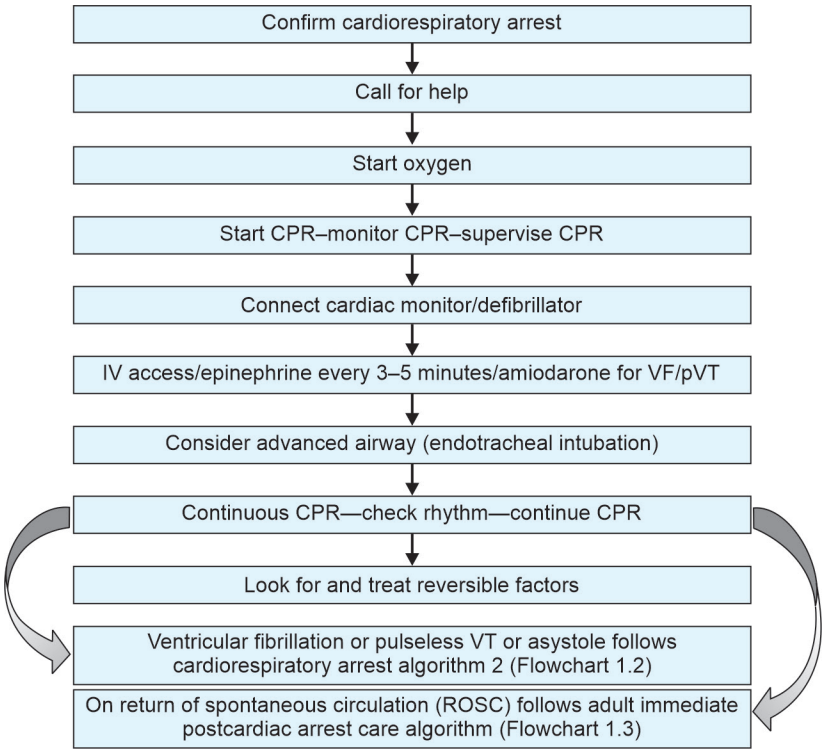
- A wide bore IV line should be secured
- Injection epinephrine 1 mg to be given every 3 to 5 minutes during the CPR until return of spontaneous circulation (ROSC)
- Injection amiodarone if the rhythm does not revert back after shocking the patient.
- Dose: 300 mg bolus, followed by a second dose of 150 mg if required.
- If amiodarone is not available, lidocaine 1 to 1.5 mg/kg first dose, then 0.5 to 0.75 mg/kg at 5 to 10 minutes intervals.

While continuing CPR, reversible causes for cardiac arrest should be looked into. These can be remembered as 5Hs and 5Ts:

Hypoxia	Tension pneumothorax
Hypo-/hypervolemia	Tamponade, cardiac
Hyperkalemia/hypocalcemia	Toxins
Hypothermia	Thromboembolism, pulmonary
Hydrogen ion (acidosis)	Thrombosis, coronary

While doing CPR, assessment for pulse should be done after every cycle. CPR can be stopped once there is **return of spontaneous circulation (ROSC)**.

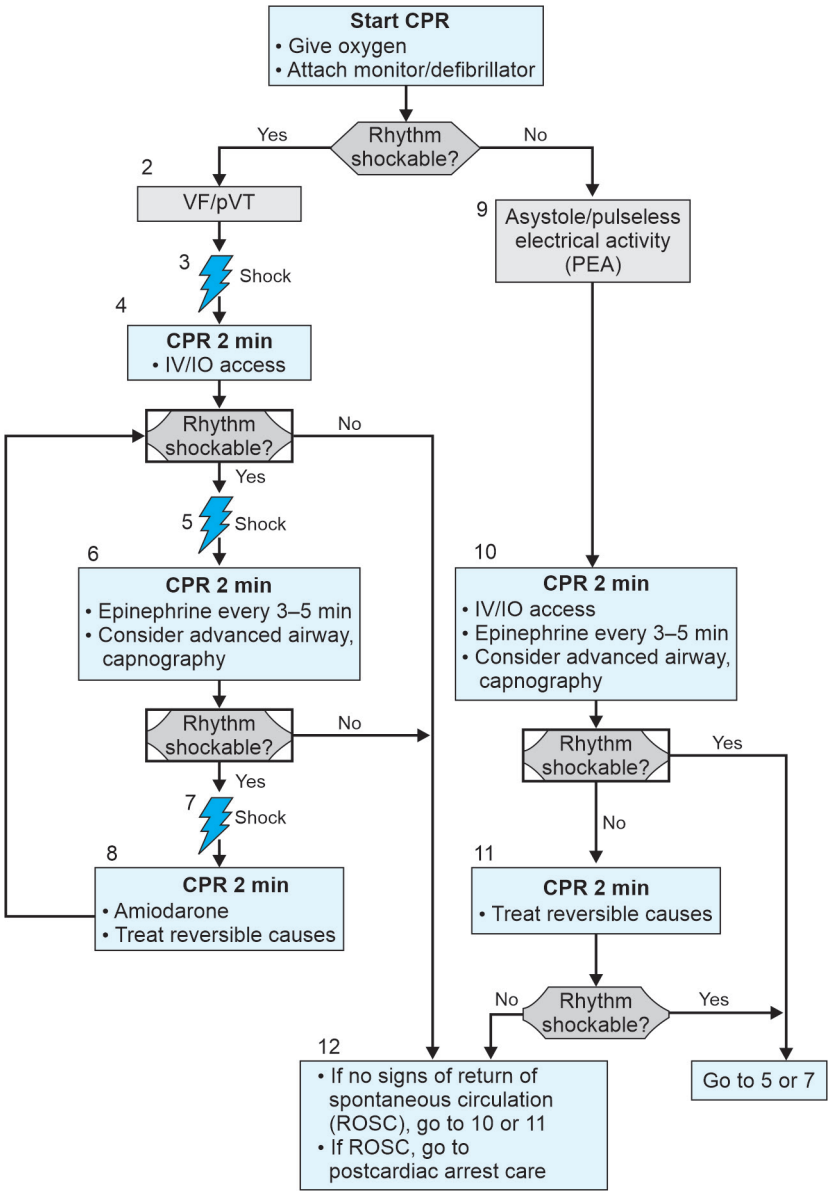
Flowchart 1.1: Cordiorespiratory arrest algorithm 1



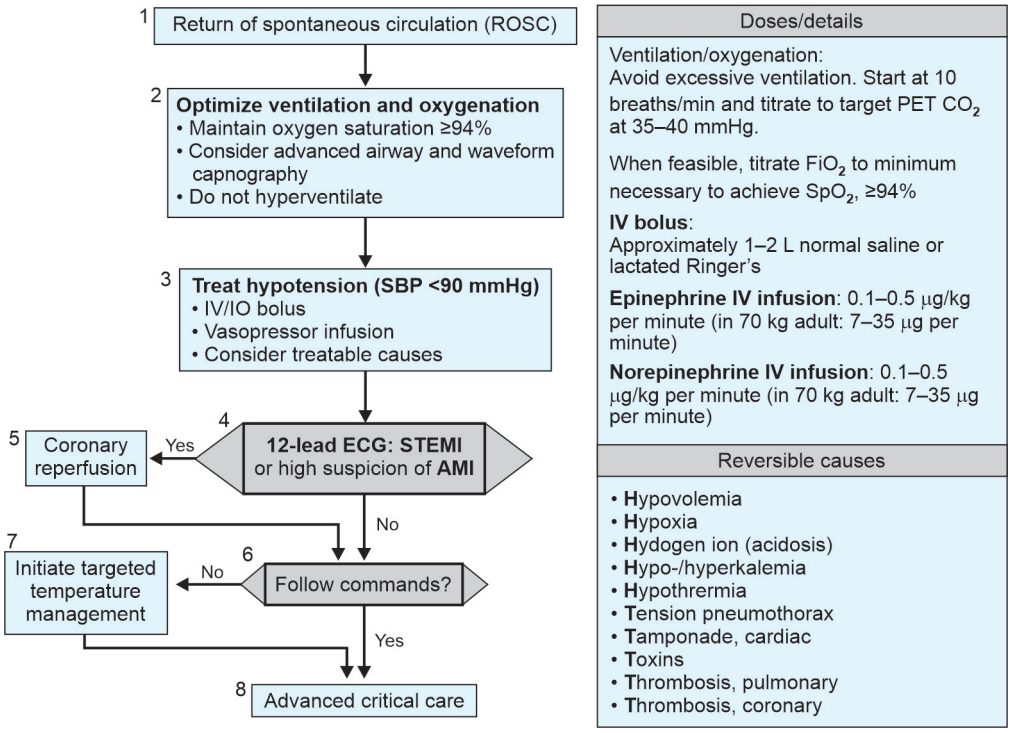
Things required for CPR

1. Suction apparatus or suction line
2. Suction tube
3. Laryngoscope
4. Ambu bag
5. Face mask
6. Endotracheal tube (ET tube)
7. Stilet for ET tube
8. Plaster for fixing the tube
9. Connecting tube between ET tube and ventilator circuit
10. Defibrillator
11. Conductance jelly
12. Cardiac monitor
13. Pulse oximeter
14. IV cannulas
15. IV fluids
16. Emergency drugs (refer to relevant chapters)

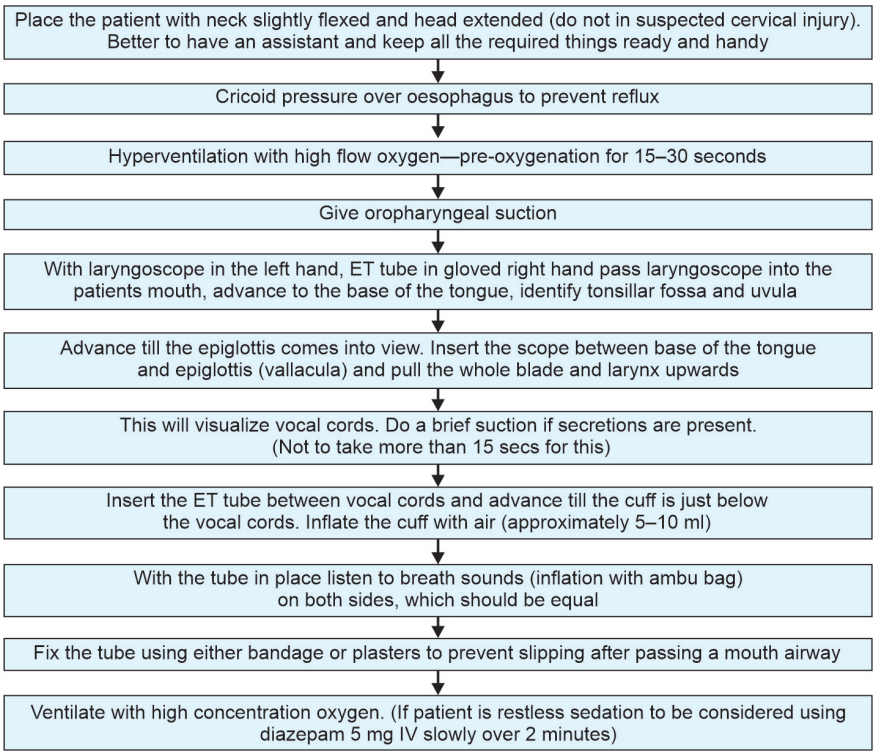
Flowchart 1.2: Cardiorespiratory arrest algorithm 2



Flowchart 1.3: Adult immediate postcardiac arrest care—2015



Procedure of Endotracheal Intubation



Illustrations of Airway Management

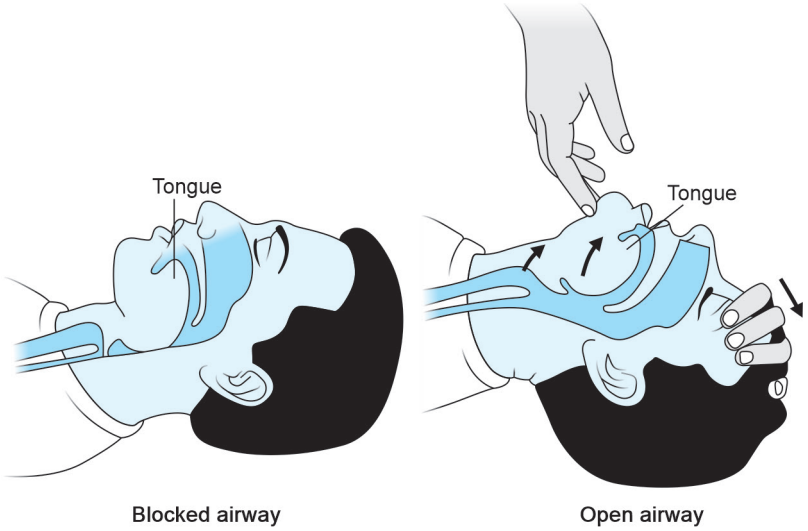


Fig. 1.2: Head tilt and chin lift

Fig. 1.3: Jaw thrust

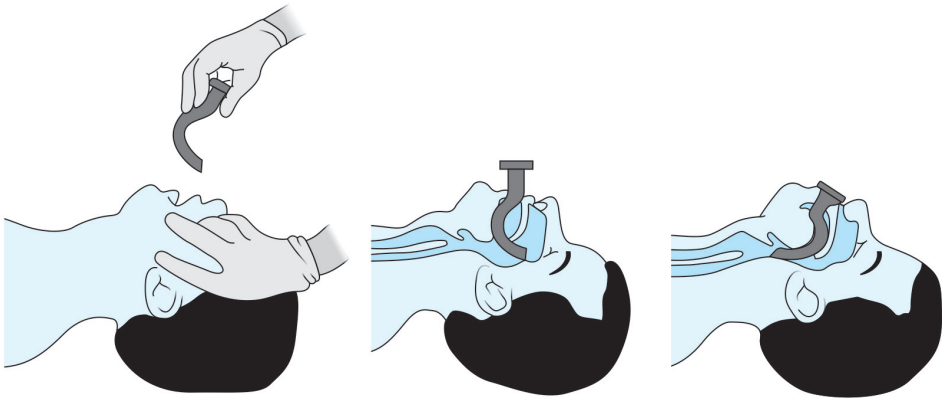


Fig. 1.4: Oral airway insertion technique

Basic CPR

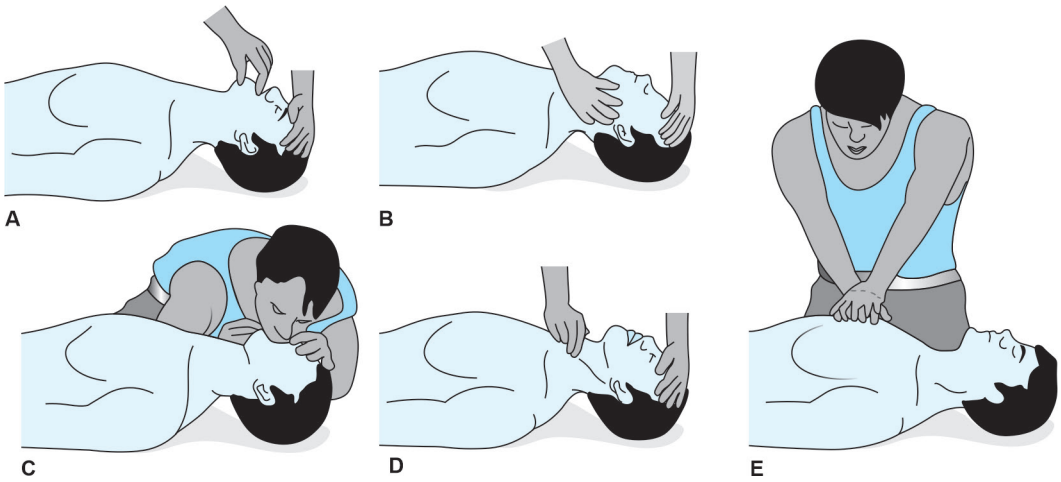


Fig. 1.5A to E: (A) The patient should be flat on his back and his mouth should be checked for debris. (B) If the victim is unconscious, open airway, lift neck, and tilt head back. (C) If victim is not breathing, begin artificial breathing with four quick full breaths; (D) Check for carotid pulse; (E) If pulse is absent, begin artificial circulation by depressing sternum

Endotracheal Intubation

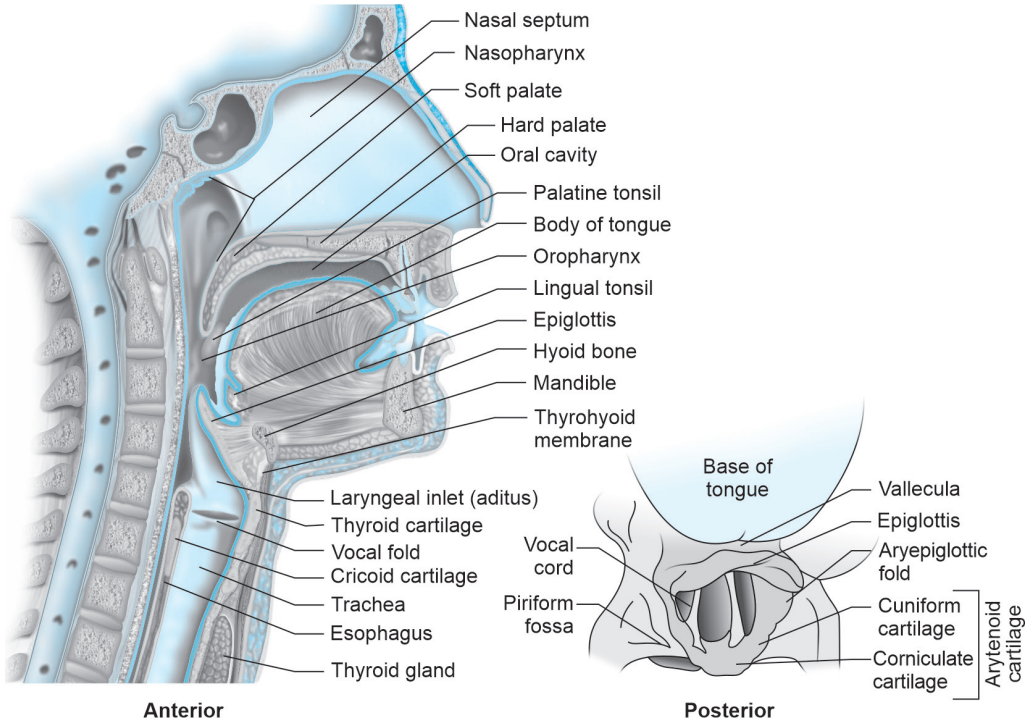


Fig. 1.6: Anatomy of oral cavity and seen during direct laryngoscope

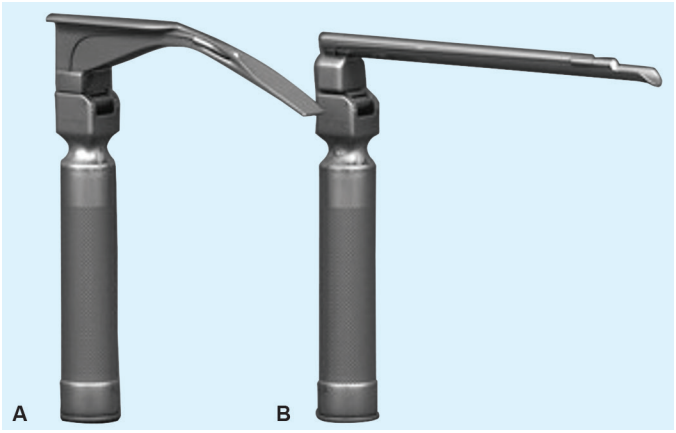


Fig. 1.7: Types of laryngoscope blades

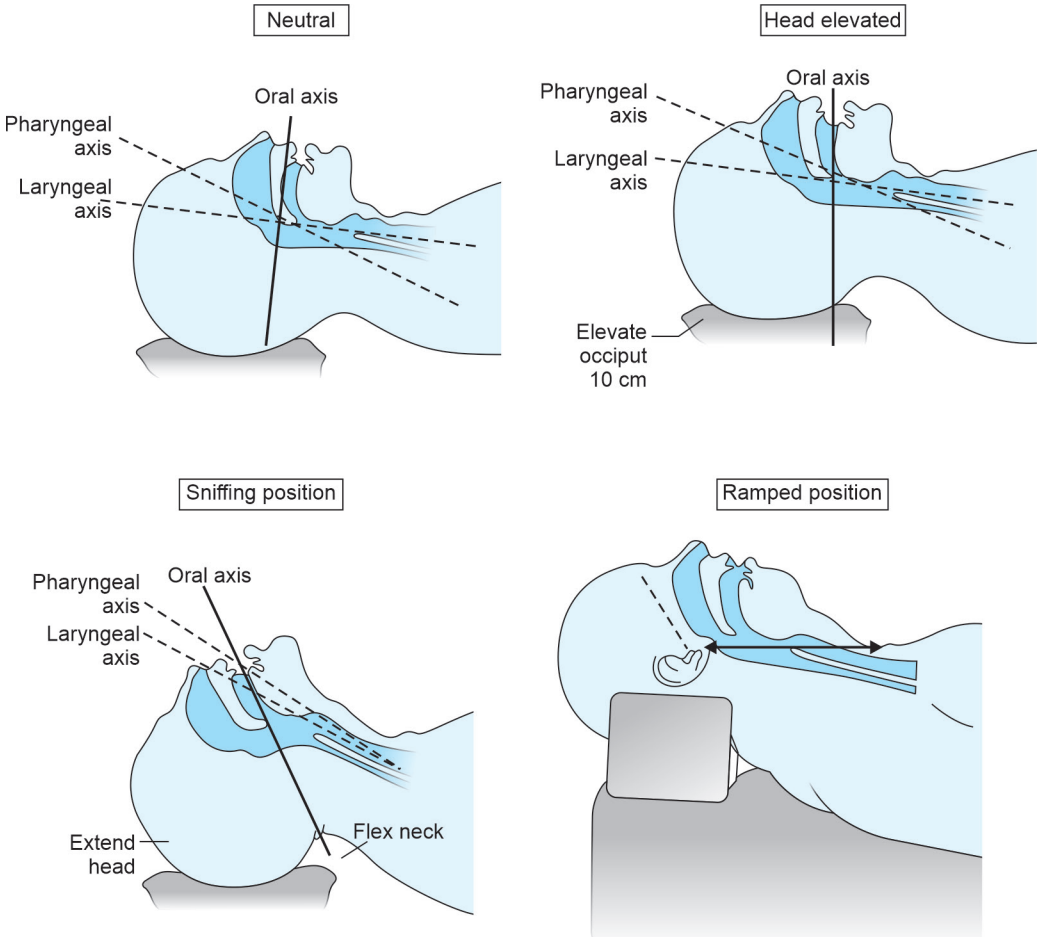


Fig. 1.8: Importance of neck position during airway management

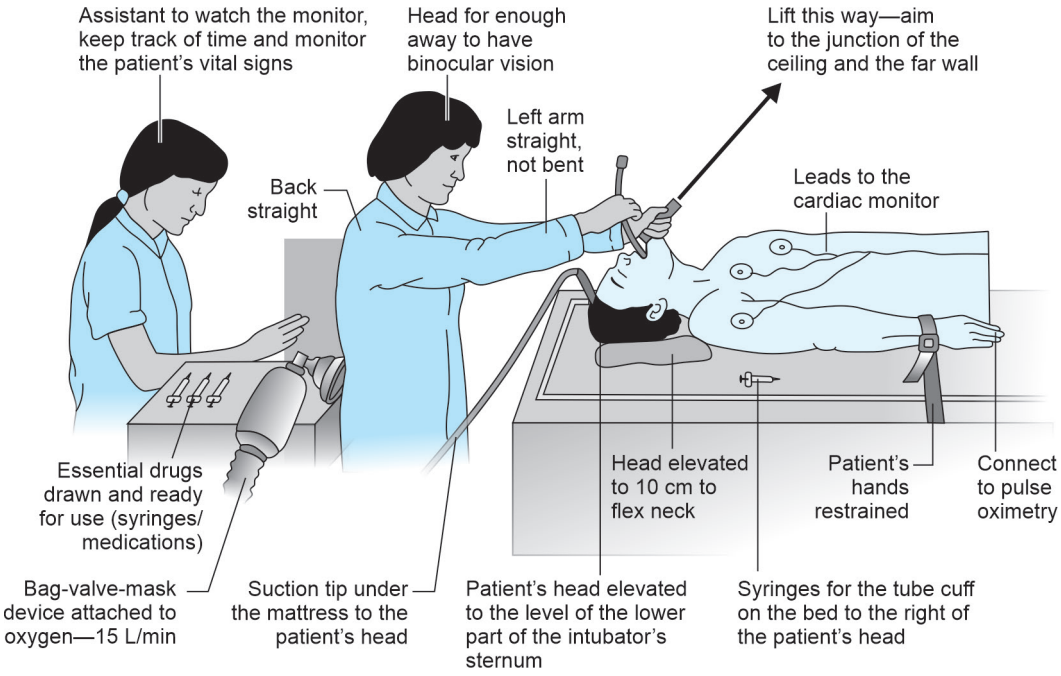


Fig. 1.9: Ideal Intubation scene

Rapid Sequence Intubation

Where it is indicated?

1. In patients who are not fasting or fasting status is not known.
2. Comorbidities with gastroparesis (diabetes, parkinsonism, on opioid therapy, severe pain and gastric banding, paralytic ileus).
3. Gastro-oesophageal reflux disease/hiatus hernia.
4. Gross obesity/second and third trimester of pregnancy/gross ascites.

Emergency Intubation Checklist

Advance planning—periodic review and drills are essential

(A) Patient, (B) equipment, (C) difficulties, and (D) team

A. Preparing the patient

- Patient monitoring
  - Pulse oximeter
  - NIBP/BP recording every 2 minutes
  - Capnography
  - ECG leads and monitor
- Patient positioning
  - Ramping in obese patient
  - 30 degree head up for head injury
  - Neck immobilization for suspect cervical spine injury patient
- Good IV access and fluid running
- Adequate preoxygenation

B. Equipment

- Oxygen supply
- Airway equipment
  - Face mask
  - Airway accessories: connecting tubes, fixer
  - Self-inflating bag
  - 2 laryngoscopes
  - Appropriate ET tubes
  - Bougie or stylet
  - Suction
  - Tube tape or tie
- Drugs for RSI
- Vasopressors
- Sedation/paralytic agents

C. Anticipated difficulties

- Video laryngoscope
- Cricothyroidotomy kit
- LMA
- Difficult airway trolley
- Oxygenation plan in case of failed intubation
- Specific problems

D. Team

- Intubator
- Drug administrator
- Airway assistant
- Supervisor/senior help

Inducing Agents

Drugs	Propofol	Ketamine	Etomidate	Midazolam	Fentanyl
Dose	1–3 mg/kg for patients who are haemodynamically stable. In elderly or hypovolemic patients 0.5–1 mg/kg	1–2 mg/kg	0.2 to 0.4 mg/kg IV	0.1–0.3 mg/kg	2–10 µg/kg TBW
Onset	30 to 45 sec	4 min	30 to 45 sec	Within 5 min	1–2 min
Duration of action	5 to 10 min	15 to 30 min	5 to 15 min	1 to 6 hr	30–60 min
Adverse effects	Hypotension because of dose-dependent venodilation, arterial dilation, and decrease in cardiac contractility	Avoid in hypertension and suspected ICP elevation no risk of hypotension	Risk of adrenal suppression in the first 12 hours	Hiccoughs, cough, nausea, and vomiting, anterograde amnesia, drowsiness, ataxia	Bradycardia, hypokalemia (rare), hypotension

Neuromuscular Blocking Agents and Reversal Agents

Used to prevent coughing, gagging, straining, and vomiting or a patient who is struggling during intubation.

Rocuronium (Preferred)

1. For non-depolarizing agent allows the fastest onset of action and the best intubating conditions, with the least side effects.
2. 0.6–1.2 mg/kg IBW.

Succinylcholine

1. 1 to 1.5 mg/kg
2. Onset within 30 to 60 seconds
3. Adverse effects: Muscle fasciculations, increase intragastric pressure, malignant hyperthermia.

In shocked patients, no adjuncts may be required

Rapid Sequence Intubation Technique

1. Patient should be positioned appropriately for pre-oxygenation and intubation. Sniffing position (atlanto-occipital extension with head elevation of 3 to 7 cm), supported so that the neck is flexed and the head extended-ensure that there is no cervical injury.
1. Secure IV cannula
2. Pre-oxygenation: Give 100% oxygen for three minutes of normal tidal volume breathing, for eight deep breaths over one minute, or until the fraction of expired oxygen is over 90 percent.
3. Give IV inducing and neuromuscular blocking agent.
4. Wait for an appropriate time period or fasciculations (if succinylcholine is used)
5. Open the airway by lifting the chin upward while tilting the forehead back. The goal is to create a straighter path from the nose to the trachea.

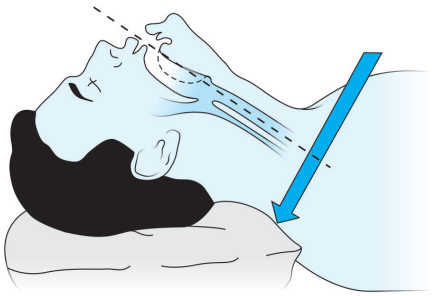


Fig. 1.10: In individuals with a suspected neck injury, the cervical spine should be protected and a jaw thrust alone is used to open the airway

6. If regurgitation is observed, suction should be rapidly applied, and the bed should be placed in a head-down (Trendelenburg) position to minimise the chance of aspiration into the trachea.
7. Once the endotracheal tube is placed, the cuff is immediately inflated
8. Ensure correct position of tube: Chest rise and fall, tube misting, auscultation of lungs on both sides in axilla to ensure equal air entry.