# Resource-Limited ENLS
# Airway, Breathing, and Mechanical Ventilation

While the approach to the patient with airway compromise in a resource-limited setting follows the same principles developed for airway management in high-resource settings, clinicians are often forced to confront resource gaps that challenge timely and safe airway stabilization in the pre-hospital and inpatient environments.

***Pre-hospital care and patient transport:*** Patients with neurologic emergencies in resource-limited environments are often first encountered by untrained bystanders and transported to health facilities that are underequipped for complex and emergent airway stabilization. To the extent that ambulance services are available, their role is most often to provide patient transport rather than delivering life-saving interventions en route to a health facility. Patients may initially present to community health facilities that lack personnel skilled in intubation or the material resources required for safe intubation, including IV access, induction and sedative medications, endotracheal tubes, ventilators, bag valve masks, supplemental oxygen, and vasopressors. Given the potential for severe patient harm or death from attempted intubation in under-equipped settings, endotracheal airway placement should not be performed outside of a hospital environment with skilled personnel and protocols for intubation and mechanical ventilation. The airway should be stabilized non-invasively by clearing secretions with a suction catheter (if available), placing an oropharyngeal airway (if available), and elevating the patient's head position to 30 degrees. The cervical spine should be stabilized for all patients with witnessed trauma of unwitnessed fall. This can be achieved using a rigid cervical collar if available, or maintaining midline head position using pillows, cushions, or sandbags on either side of the patient's head, using caution to ensure that the oral and nasal cavities are not obstructed. For all patients with a threatened airway, immediate transfer should be arranged to a tertiary care center equipped for advanced airway management (see table 1 for signs of threatened airway)

**Table 1**

Pre-hospital airway assessment and stabilization in resource-limited environments

| Indications for transfer to higher level of care | Methods for pre-hospital airway stabilization |
|---|---|
| Depressed mental status (GCS < 9) | Elevate head of bed to > 30 degrees |
| Pooling secretions in the oropharynx | Clear oral secretions with suction catheter |
| Hypoxemia (oxygen saturation < 94%) | Place oropharyngeal airway (if available) |
| Airway compromise from head or neck trauma | Supplemental oxygen |
| Foreign body aspiration | Cervical spine stabilization |
| Increased work of breathing | Arrange emergent transfer to referral hospital |
| Stridor | |
| Neuromuscular respiratory failure (myasthenic crisis, rapidly progressive Guillain-Barré syndrome) | |

***Emergency department/inpatient airway management:*** Intubation should be led by an experienced physician capable of overseeing all aspects of the procedure and organizing personnel to ensure patient safety during and after intubation. In settings with limited critical care bed space in the emergency department or ICU, a plan for the patient's post-intubation disposition, ventilator management, and bedside nursing care should be established in parallel with procedural preparations. If available, patients should be connected to continuous cardiac telemetry and pulse oximetry monitoring. The blood pressure should be monitored every two minutes, and in settings without

automated blood pressure cuffs, a staff member should be assigned to measure, report, and record manual blood pressure readings throughout the procedure. The availability of individual vasopressor agents varies widely in resource-limited settings as most vasopressors are not included on the World Health Organization's List of Essential Medications,[1] and clinicians should refer to their hospital formulary for selection of available medications for blood pressure support in hemodynamically unstable patients. Likewise, the choice of sedatives and paralytics for induction of anesthesia are likely to be highly variable, though most settings are likely to have some combination of propofol, midazolam, or ketamine for sedation and succinylcholine or non-depolarizing neuromuscular blockers (rocuronium, vecuronium, cisatracuronium) for paralysis. Finally, the correct placement of the endotracheal tube should be confirmed by all available methods. These include bedside indicators such as bilateral breath sounds, chest rise, condensation within the endotracheal tube, and stable oxygen saturation post-intubation. If available, a chest radiograph should be performed to image the location and depth of the endotracheal tube. The patient's ventilatory status should be monitored using end tidal CO2 and intermittent arterial blood gases, though these may be unavailable in many settings. If there is any doubt about the position of the endotracheal tube, it should be immediately removed and replaced by the most experienced personnel available.

**References**

1. World Health Organization. WHO Model List of Essential Medicines - 23rd list, 2023.