ARKANSAS DEPARTMENT OF HEALTH

SECTION OF EMS

PHARMACEUTICAL ASSISTED INTUBATION (PAI)

Guidelines

(Rev 12/2023)

I. Overview

Pharmaceutical Assisted Intubation (PAI) is a method of using a combination of medications to provide analgesia, sedation, and paralysis to secure an airway. An additional term that you may see in the literature being developed to describe this process is Drug Assisted Airway Management (DAAM). The PAI procedure may be necessary in patients who present with issues that may make intubation difficult. This may include, but not limited to, patients with an intact gag reflex, clenched jaw, status epilepticus, patient's inability to protect their airway due to depressed mental status as in trauma, sepsis, or stroke, impending respiratory ventilatory or oxygenation failure not responsive or contraindicated to non-invasive measures such as non-invasive (NIV) or non-rebreather mask (NRB), or anticipated deteriorated clinical course (i.e., severe airway burns, massive facial trauma).

Although the physical endotracheal intubation procedure itself remains the same, the serious nature of using paralytic medications requires excellent critical thinking skills, advanced pharmacology knowledge, and continuous training. While much attention is required for the process of correctly inserting the ET tube into the trachea, it is critical to consider the physiological effects of this process on the patient. Meticulous attention should be paid to avoid hypoxemia and hypotension during intubation attempts limiting patient morbidity and mortality. This can be achieved through proper pre-procedure preparation of the patient for optimal intubation. PAI should only be used if less invasive methods do not meet patient care goals and should only be performed within EMS agencies with established educational programs and quality management systems that demonstrate continued proficiency. PAI converts a breathing patient to a patient without ventilations and removes their sympathetic compensation by administering sedative, analgesic, and paralytic medications.

Pharmaceutical Assisted Intubation exists along a spectrum of duration of the procedure including Crash Intubation, Rapid Sequence Intubation (RSI), and Delayed Sequence Intubation (DSI). The urgency of the intubation process and the medications required is determined by the acuity of the situation and the stability of the patient. A patient with severe hypoxia and vomitus or blood in the airway would likely need to be managed more rapidly than a patient who is just hypoxic and can be resuscitated before the intubation process. A delayed sequence intubation allows the paramedic to maximize the patient's oxygen saturation and hemodynamic status before the actual intubation process to help reduce the likelihood of the

patient decompensating. Initiating an RSI procedure prematurely on a patient who is hypoxic and hemodynamically unstable can lead to critical desaturations and cardiac arrest. Preoxygenation and resuscitation before intubation are critical to patient safety. Multiple ETI attempts contribute to complications and poor patient outcomes.

Consider the following to increase first-pass success:

1. Use of a checklist

2. Optimal patient positioning

3. Video laryngoscopy

4. Bougie (if standard geometry laryngoscope) and

5. Using the most experienced EMS clinician.

Due to the potential complications involved with PAI, not all paramedics are eligible to perform the procedure. A training program approved by the ADH Section of EMS is required for every ambulance service applying to practice PAI procedures as well as a thorough documentation process and quality review for each procedure attempted.

The performance of this skill is limited to patients 8 years of age or older.

Pediatric patients are a heterogeneous group, and airway management strategies must optimize ventilation and oxygenation while minimizing complications. BVM is the starting point of positive pressure ventilation and may progress to SGA, however, progression to ETI should be done rarely in the face of lower ETI success rates, higher complication rates, and lower patient volumes leading to decreased experience in this population. The clinical status of the patient should guide all decisions based on ongoing assessment, monitoring, etiology, and expected clinical course. Pediatric airway management requires appropriate tools and adjuncts based on patient size/age. An objective, standardized, commercial method for determining appropriate equipment sizing and ETI placement depth should be available to all EMS clinicians. Skill in BVM ventilation and NIPPV application should be emphasized in pediatrics and supraglottic airways are reasonable primary and secondary adjuncts, if needed. Pediatric endotracheal tube placement and maintenance requires significant training to achieve and maintain competency. EMS Clinicians are less likely to attempt endotracheal intubation in children than adults with cardiac arrest. They are more likely to be unsuccessful when intubating children in a non-cardiac arrest scenario. Complications such as malposition of the ETT or aspiration can be nearly three times as common in children as compared to adults. Appropriate securing of the invasive airway and close monitoring for dislodgement is critical, especially with a smaller child.

II. Qualifications to Participate in PAI

The service medical director and training coordinator will select individuals to participate in the program. All participants must meet the training requirements as outlined in Sections IV and VI.

III. Responsibilities of the Ambulance Service Medical Director

- Approve the PAI Program to be submitted for review/approval by the Section of EMS.
- Select or approve participant paramedic providers.
- Monitor PAI training. All paramedics should receive PAI skills validation annually.
- Evaluate and monitor the skills of participants. The paramedic must have a minimum of three (3) successful intubations every six (6) months (human or mannikin).
- Review all PAI attempts through submitted patient care reports (PCR) expeditiously and document the review (email record with training coordinator or QA/QI note in PCR.) The medical director shall review the PCR for verification of appropriate indications documented for the PAI procedure, medication selection and administration, and review of pre- and post-intubation management and provide feedback to the provider.
- Initiate training/remediation as needed. If a paramedic has not performed a PAI procedure within one (1) year, the paramedic must be checked off by the EMS agency's training department and medical director.

IV. Implementation of a PAI Protocol

A. PAI utilization in the pre-hospital emergency setting:

Ambulance services electing to perform PAI procedures will be required to **submit** the following to the EMS Section for **review and approval before initiation of the protocol:**

- Paramedics who wish to be approved by the Section of EMS to perform PAI must complete the mandatory training courses (PAI and Difficult Airway). All paramedics providing PAI must be signed off by a service-approved trainer/instructor and by the service medical director.
- The Service medical director's proposed PAI procedure protocol, which should include contraindications/considerations and sedation maintenance. PAI protocols must include text stating that the PAI procedure for paramedics is limited to patients 8 years of age and older.
- A statement, signed by the medical director and service director, must be attached to the protocol stating that appropriate education and training will be provided to approved paramedics before utilization of skills/procedures.

B. Paramedics performing PAI procedures in a Hospital Setting

Pursuant to ACT 293 of 1981, a hospital may permit an EMSP to perform specified procedures within the emergency department, a critical care area, or as a member of an emergency code team. For an Arkansas-licensed paramedic to perform skills for which they are licensed within a hospital, the EMSP shall ensure that the following actions have been taken by the hospital:

1. The medical staff must approve the privileges granted to the individual EMSP with the concurrence of the hospital's governing body. Specific policies governing the supervision and the procedures to be performed by the EMSP must be developed by the hospital medical staff and approved by the hospital's governing body. EMSPs may not perform a procedure on a patient in a hospital that he or she is not licensed to perform.
2. Approved EMSPs in a hospital setting must function in accordance with the physician's orders and under the direct supervision of either the physician or the registered nurse responsible for emergency services within a hospital.
3. In addition, with hospital concurrence, students in EMSP training programs must be trained by qualified personnel within the hospital under guidelines established by the medical staff and approved by the hospital governing body.
4. A roster with the delineation of privileges shall be maintained and readily available.

Each paramedic participant must complete the specified training program for the ambulance service/hospital where he/she is employed. If a paramedic works at multiple ambulance services or hospitals, he/she must complete the training program for each employer and obtain approval from each service medical director or hospital governing body by which they are employed.

V. PAI Requirements

Once approval of a PAI protocol has been obtained from the Section of EMS, the following must be conducted:

- All employees approved to perform the PAI procedures should be educated on all documentation/data points required on all PAI ePCRs as detailed in Section IV. below.
- A copy of all PAI ePCRs will be sent to the ambulance service medical director and training coordinator immediately following the call. The ambulance service medical director will review each call for appropriate and inappropriate treatment decisions to use PAI.
- Ambulance services will utilize the Section of EMS PAI Tracking Procedure Log Sheet (which may be found on the ADH website) for each patient with demographics on whom the PAI Procedure is performed. The electronic form shall be due by the fifth(5^{th}) day of the following month listing all PAI procedures performed for the previous month.
- The participating ambulance service will be required to provide a semi-annual report to the Section of EMS regarding utilization of procedures and a QA/QI program update related to PAI procedures, including remediation and/or removal of PAI-approved providers. These reports shall be in a written/typed format signed (original signature of the medical director) and submitted to the Section on **April 1st and September 1st** of each year. Performance Measures may be located on the National EMS Quality Alliance (NEMSQA) website under Performance Measures (www.nemsqa.org).
- Reports shall consist of the following:
    - Number of employees trained to perform PAI during the semi-annual period.
    - Names and AR EMT License numbers of employees trained and approved to perform the PAI procedure.
    - Number of patients receiving PAI procedures
    - Patient indications for PAI and outcome regarding procedure

- Successful/failed intubation attempts and airway device(s) utilized
- List the training coordinator and contact information

- **Email all Semi-annual reports to adhems@arkansas.gov.**

VI. Outline of Initial Training

All applicants must meet the training requirements as outlined. Successful completion of an approved "Difficult Airway" course is required for all paramedics before performing PAI procedures. Additionally, Department approved instructors are to teach the following educational guidelines for PAI training.

PAI Procedure Assessment, Preparation, and Management

Nine Ps of the PAI Procedure:

1. Plan
2. Prepare (medications, equipment, patient, and personnel)
3. Protect C-spine
4. Pre-Oxygenate (Nitrogen Washout)-at least 3 minutes high flow NC plus NRB/BVM
5. Pre-Treatment Medications
6. Paralysis and Induction
7. Positioning
8. Placement of ET Tube and Proof
9. Post-Intubation Management

Patient Care Goals:

1. Establish and/or maintain a patent airway.

2. Optimize patient outcomes, support/correct oxygenation and/or ventilation, and provide airway protection using the least invasive and most effective manner at the scene and during transport.

3. Minimize complications from airway interventions.

4. Perform clinical assessments and monitor the patient's overall physiological response to the interventions.

A. Comprehensive Ventilation Assessment

1. Purpose
2. Procedure
3. Minute Volume-Tv x rate
4. Tidal volume
5. Evaluating the effects of artificial ventilation-Invasive and NIV
6. Pulse Oximetry
   a) Purpose

b) Indications
c) Contraindications
d) Complications and limitations of the technology
e) Procedure

7. Continuous End Tidal Waveform CO2 Capnography
   a) Purpose
   b) Indications
   c) Contraindications
   d) Complications and limitations of technology
   e) Procedure
8. Blood Gas Analysis
   a) pH
   b) PaCO2
   c) PaO2
   d) HCO3
   e) Base Deficit

B. Review of Ventilation Devices used by EMTs and EMT-Ps

1. Manual Devices-Bag Valve Mask w/ or w/o PEEP
   a) Purpose
   b) Indications
   c) Contraindications
   d) Complications
   e) Procedure
2. Mechanical Devices-Non-Invasive and Invasive
   a) Purpose
   b) Indications
   c) Contraindications
   d) Complications
   e) Procedures

C. Assisting Patient Ventilations

1. Review of Techniques used by EMTs and EMT-Ps
   a) Purpose
   b) Indications
   c) Contraindications
   d) Complications
   e) Procedure

2. Review of the physiologic differences between normal ventilation and positive pressure ventilation.

3. BiPAP/CPAP
   a) Purpose
   b) Indications
   c) Contraindications
   d) Complications

e) Procedure

4. Positive End Expiratory Pressure (PEEP)
   a) Purpose
   b) Indications
   c) Contraindications
   d) Complications

D. Assessing the airway for successful PAI

1. LEMON
   a) Look Externally
   b) Evaluate 3-3-2
   c) Mallampati Score
   d) Obstruction
   e) Neck Mobility

2. HEAVEN
   a) Hypoxia
   b) Extremes of Size
   c) Anatomic abnormalities
   d) Vomit/blood/fluid
   e) Exsanguination
   f) Neck Mobility Issues

E. Pharmacologic Categories

1. Pretreatment Medications
   a) Fentanyl
   b) Atropine
   c) Lidocaine

2. Induction Agents
   a) Etomidate
   b) Ketamine
   c) Midazolam
   d) Propofol

3. Paralytic Agents
   a) Nondepolarizing agents
      1. Rocuronium
      2. Vecuronium
   b) Depolarizing agent
      1. Succinylcholine

4. Post Intubation Management
   a) Analgesia
      1) Fentanyl

2) Morphine
3) Hydromorphone

b) Sedation
1) Midazolam
2) Lorazepam
3) Diazepam
4) Ketamine
5) Dexmedetomidine
6) Propofol

5. Paralytic Reversal Agents
a) Neostigmine
b) Sugammadex

F. Procedure: See Ambulance Service's Specific Procedure and Protocol

G. Monitoring - Implement emergent interventions and monitoring

1. Monitoring during airway management includes frequent assessment of vital signs, adequate ventilatory rates/volumes, end-tidal CO2(EtCO2) monitoring, and continuous pulse oximetry.

2. Patients with significant respiratory distress should have continuous pulse oximetry and waveform capnography monitoring to assess and guide therapy.

a) Pulse oximetry is indicated to assess oxygenation.

b) Quantitative waveform capnography, either nasal prong or in-line EtCO2 is indicated:

i. To confirm placement and ongoing function of invasive airway management.

ii. To assess and monitor ventilatory status in patients with significant respiratory distress, with or without airway adjuncts.

iii. To evaluate acid-base status in critically ill patients. As a monitoring and decision-making tool for patients with significant respiratory distress, interpretation of the capnography waveform and EtCO2 values assist in determining the appropriate course of treatment and corresponding response.

3. Adjustments in ventilatory rate:

a) To maintain EtCO2 35–45 mmHg in most patients.

b) To appropriately but not excessively hyperventilate patients with signs of herniation only to maintain EtCO2 30–35 mmHg (no lower than 30 mmHg).

c) To gradually decrease EtCO2 in chronically and acutely severe hypercarbic patients, including post-arrest.

d) To match the initial compensatory ventilatory rate in patients with metabolic acidosis who undergo invasive airway management to avoid rapid physiologic deterioration from loss of compensatory tachypnea

4. Patients with altered mental status should be monitored to ensure adequate airway protection, oxygenation, and ventilation.

5. Gastric decompression can improve oxygenation and ventilation and should be strongly considered in any patient with positive pressure ventilation, especially in pediatric patients.

6. Head elevation to 30-45 degrees is encouraged when tolerated and without contraindication is associated with lower rates of ventilator-associated pneumonia.

H. Special Populations- Physiologic and Hemodynamic considerations:

1. Pediatric
2. Pregnant
3. Geriatric

VII. Data Collection Requirements

These data points must be captured within the patient care report (PCR). All other required electronic PCR (ePCR) data fields must also be included. All PCRs where PAI was performed must be reviewed by the EMS agency's medical director to ensure all data points are included.

- Date of Run:(month/day/year)
- EMS Run Number
- Name of Ambulance Service
- Names of all EMS providers providing care. Name of EMSP performing intubation.
- All patient demographics
- Patient weight
- Vital signs for both pre-PAI procedure and post-RSI procedure: blood pressure, pulse, respiratory rate, GCS, O2 saturation, and ETCO2 (**ETCO2 monitoring is required for all PAI Procedures**) Vital signs should be recorded every 5-10 minutes. Breath sounds in all fields before and after the procedure.
- Equipment used and size
- Medications (drug, dose, route, and time)

The narrative must include the following:

- Indications for PAI procedure vs standard endotracheal intubation

- Response to or contraindications to non-invasive measures
- Type and size of a laryngoscope or Video laryngoscope used. Recordings of video laryngoscopy may be useful for quality improvement purposes.
- Alternate/backup airway devices available
- Number of Attempts for successful intubation
- Total time for the procedure (time from the first drug in PAI procedure until successful intubation)
- ET Tube confirmation method (e.g., absent gastric sounds, bilateral breath sounds, symmetric rise and fall of chest, ET tube mist/condensation, ETCO2 colorimetric or quantitative waveform values, visualization of cord through vocal cords, video/photo capture of ET tube through cords, patient clinical improvement, pulse oximetry improvement, etc.)
- Device used to secure ET tube.
- Neck stabilization device used to protect/prevent ET tube displacement in transport/transfer.
- Complications of PAI procedure, if any (e.g., aspiration, bradycardia, vomiting, oropharyngeal injury, hypoxia, hypo/hypertension)

Additional data is required if PAI was unsuccessful. The following must be documented:

- Unsuccessful attempts by EMSP (note provider name)
- Rescue airway device attempted and if it was successful.
- Suspected reasons for failed intubation (e.g., difficult anatomy, equipment failure, inability to visualize cords, orofacial trauma, inadequate patient sedation/paralysis, etc.)

*For documentation, the Section of EMS defines an endotracheal intubation (ETI) attempt as placing a laryngoscope/video laryngoscope blade into the mouth/oropharynx with the intent to intubate. A nasotracheal intubation (NTI) attempt is defined as when the tube is placed into the nares with the intent to intubate.

Using the laryngoscope blade as an adjunct to using Magill forceps is not an ETI attempt. Providers should ensure documentation of the use of Magill forceps is noted in the procedure section for each attempt. Providers should ensure documentation of the use of suction is noted in the procedure section for each attempt, and it should be noted if the laryngoscope blade was utilized on the first suction.

Inappropriate Treatment:

In the instance that a PAI is performed inappropriately, the ambulance service medical director will make a written recommendation detailing a plan for the provider's remediation. If remediation is inadequate, unsuccessful, or refused, the paramedic will be removed from the approved provider's list.

References:

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- A Novel Difficult-Airway Prediction Tool for Emergency Airway Management: Validation of the HEAVEN Criteria in a Large Air Medical Cohort
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  https://emedicine.medscape.com/article/2172130-overview
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- Prehospital Drug Assisted Airway Management: An NAEMSP Position Statement and Resource Document, Jeffrey L. Jarvis, John W. Lyng, Brian L. Miller, Michael C. Perlmutter, Heidi Abraham & Ritu Sahni (2022) Prehospital Emergency Care, 26:sup1, 42-53, DOI: 10.1080/10903127.2021.1990447
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- Prehospital Airway Management Evidence Based Guideline National Association of State EMS Officials, https://nasemso.org/wp-content/uploads/Model-Clinical-Guideline-Prehospital-Airway-Management.pdf