

Peoria Area EMS System Critical Care Protocols

Definitions

Section 515.860 Critical Care Transport

- a) *"Critical care transport" means the pre-hospital or inter-hospital transportation of a critically injured or ill patient by a vehicle service provider, including the provision of medically necessary supplies and services, at a level of service beyond the scope of the EMT-Paramedic. When medically indicated for a patient, as determined by a physician licensed to practice medicine in all of its branches, an advanced practice nurse, or a physician's assistant, in compliance with Section 3.155(b) and (c) of the Act, critical care transport may be provided by:*
- 1) *Department-approved critical care transport providers, not owned or operated by a hospital, utilizing EMT-Paramedics with additional training, nurses, or other qualified health professionals; or*
 - 2) *Hospitals, when utilizing any vehicle service provider or any hospital-owned or operated vehicle service provider. Nothing in the Act requires a hospital to use, or to be, a Department-approved critical care transport provider when transporting patients, including those critically injured or ill. Nothing in the Act shall restrict or prohibit a hospital from providing, or arranging for, the medically appropriate transport of any patient, as determined by a physician licensed to practice medicine in all of its branches, an advanced practice nurse, or a physician's assistant. (Section 3.10(f-5) of the Act)*
- b) *All critical care transport providers must function within a Department-approved EMS System. Nothing in this Part shall restrict a hospital's ability to furnish personnel, equipment, and medical supplies to any vehicle service provider, including a critical care transport provider. (Section 3.10(g-5) of the Act)*
- c) For the purposes of this Section, "expanded scope of practice" includes the accepted national curriculum plus additional training, education, experience, and equipment (see Section 515.360) as approved by the Department pursuant to Section 3.55 of the Act. Tier I transports are considered "expanded scope of practice".
- d) For the purposes of this Section, critical care transport plans are defined in three tiers of care. Tier II and Tier III are considered Critical Care Transports.
- e) Tier I
Tier I provides a level of care for patients who require care beyond the paramedic USDOT Curriculum scope of practice, up to but not including the requirements of Tiers II and III. Tier I transport includes the use of a ventilator, the use of infusion pumps with administration of medication drips, and maintenance of chest tubes.
- 1) Personnel Staffing and Licensure
 - A) Licensure:
 - i) Licensed Illinois Paramedic or Pre-Hospital Registered Nurse (PHRN);
 - ii) Scope of practice more comprehensive than USDOT Curriculum, as approved by the Department in accordance with the EMS System Plan (see Sections 515.310 and 515.330); and
 - iii) Approved to practice by the Department in accordance with the EMS System Plan.

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- B) Minimum Staffing:
 - i) EMT-Basic, Intermediate or Paramedic/PHRN as driver; and
 - ii) Paramedic Expanded Scope of Practice credentialed individual or PHRN, who shall remain with the patient at all times.
- 2) Education, Certification, and Experience
 - A) Initial Education: Documentation of initial education and demonstrated competencies of expanded scope of practice skills as required by Tier I Level of Care and approved by the Department in accordance with the EMS System Plan.
 - B) Continuing Education Requirements:
 - i) Annual competencies of expanded scope of practice knowledge, equipment and procedures shall be completed; and
 - ii) The EMS vehicle service provider shall maintain documentation of competencies and provide documentation to the EMS Resource Hospital upon request.
 - C) Certifications – Tier I personnel shall maintain all renewable critical care certifications and credentials in active status:
 - i) Advanced Cardiac Life Support (ACLS);
 - ii) Pediatric Education for Pre-Hospital Professionals (PEPP) or Pediatric Advance Life Support (PALS); and
 - iii) International Trauma Life Support (ITLS) or Pre-Hospital Trauma Life Support (PHTLS).
 - D) Experience:
 - i) Minimum of one year of experience functioning in the field at an ALS level; and
 - ii) Documentation of education and demonstrated competencies of expanded scope of practice skills required for Tier I Level of Care, approved by the Department and included in the EMS System Plan.
- 3) Medical Equipment and Supplies
 - A) Ventilator; and
 - B) Infusion pumps.
- 4) Vehicle Standards

Any vehicle used for providing expanded scope of practice care shall comply at a minimum with Section 515.830 (Ambulance Licensing Requirements) or Sections 515.900 (Licensure of SEMSV Programs –General) and 515.920 (SEMSV Program Licensure Requirements for All Vehicles) regarding licensure of SEMSV programs and SEMSV vehicle requirements, including additional medical equipment and ambulance equipment as defined in this Section. Any vehicle used for expanded scope of practice

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transport shall be equipped with an onboard alternating current (AC) supply capable of operating and maintaining the AC current needs of the required medical devices used in providing care during the transport of a patient.

- 5) Treatment and Transport Protocols shall address the following:
 - A) EMS System Medical Director or Designee present at established Medical Control;
 - B) Communication points for contacting Medical Control and a written Expanded Scope of Practice Standard;
 - C) Written operating procedures and protocols signed by the EMS MD and approved for use by the Department in accordance with the System Plan; and
 - D) Use of a ventilator, infusion pumps with administration of medication drips, and maintenance of chest tubes.

- 6) Quality Assurance Program
 - A) The Tier I transport provider shall develop a written Quality Assurance (QA) Plan approved by the EMS System and the Department in accordance with subsection (e)(6)(D). The provider shall provide quarterly QA reports to the assigned EMS Resource Hospitals for the first 12 months of operation.
 - B) The EMS System shall establish the frequency of quality reports after the first year if the System has not identified any deficiencies or adverse outcomes.
 - C) A Medical Director shall oversee the QA Program.
 - D) The QA Plan shall evaluate all expanded scope of practice activity for medical appropriateness and thoroughness of documentation. The review shall include:
 - i) Review of transferring physician orders and evidence of compliance with those orders;
 - ii) Documentation of vital signs and frequency and evidence that abnormal vital signs or trends suggesting an unstable patient were appropriately detected and managed;
 - iii) Documentation of any side effects/complications, including hypotension, extreme bradycardia or tachycardia, increasing chest pain, dysrhythmia, altered mental status and/or changes in neurological examination, and evidence that interventions were appropriate for those events;
 - iv) Documentation of any unanticipated discontinuation of a catheter or rate adjustments of infusions, along with rationale and outcome;
 - v) Review of any Medical Control contact for further direction;
 - vi) Documentation that any unusual occurrences were promptly communicated to the EMS System; and

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- vii) A root cause analysis of any event or care inconsistent with standards. The EMS System educator shall assess and carry out a corrective action plan.
 - E) The QA Plan will be subject to review as part of an EMS System site survey and as deemed necessary by the Department (e.g., in response to a complaint).
- f) Tier II
 - Tier II provides a level of care for patients who require care beyond the USDOT Curriculum and expanded scope of practice ALS (paramedic) transport program, and who require formal advanced education for ALS paramedic staff. Tier II transport includes the use of a ventilator, infusion pumps with administration of medication drips, maintenance of chest tubes, and other equipment and treatment, such as, but not limited to: arterial lines; accessing central lines; medication-assisted intubation; patient assessment and titration of IV pump medications, including additional active interventions necessary in providing care to the patient receiving treatment with advanced equipment and medications.
 - 1) Personnel Staffing and Licensure
 - A) Licensure – Licensed Illinois Paramedic or PHRN:
 - i) Expanded scope of practice more comprehensive than USDOT Curriculum and expanded scope Tier I level; and
 - ii) Approved to practice by the EMS System and the Department in accordance with the EMS System Plan.
 - B) Minimum Staffing:
 - i) Paramedic/PHRN; and
 - ii) Paramedic or PHRN who is critical care prepared, who shall remain with the patient at all times.
 - 2) Education, Certification and Experience
 - A) Initial Advanced Formal Education:
 - i) 80 hours established higher collegiate education or equivalent critical care education based on existing university program models; and
 - ii) Demonstrated competencies, as documented by the EMS System.
 - B) Continuing Education Requirements:
 - i) The EMS System shall document and maintain annual competencies of expanded scope of practice knowledge, equipment and procedures;
 - ii) The following current credentials, as a minimum, shall be maintained: ACLS, PEPP or PALS, ITLS or PHTLS;
 - iii) Twelve hours of critical care level education shall be completed annually;

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- iv) The EMS provider shall maintain documentation of compliance with subsections (f)(2)(B)(i) through (iii) and shall provide documentation to the EMS Resource Hospital upon request; and
 - v) Critical care certification (from formal education) shall be maintained when criteria are available for renewal status of certification.
 - C) Certifications – Tier II personnel shall maintain the following renewable critical care certifications and credentials in active status:
 - i) ACLS;
 - ii) PEPP or PALS; and
 - iii) ITLS or PHTLS.
 - D) Experience – Minimum of two years experience functioning in the field at an ALS level for paramedic or PHRN.
- 3) Medical Equipment and Supplies
 - A) Ventilator; and
 - B) Infusion pumps.
- 4) Vehicle Standards

Any vehicle used for providing critical care transport shall comply at a minimum with Section 515.830 (Ambulance Licensing Requirements) or Sections 515.900 (Licensure of SEMSV Programs – General) and 515.920 (SEMSV Program Licensure Requirements for All Vehicles) regarding licensure of SEMSV programs and SEMSV vehicle requirements, including additional medical equipment and ambulance equipment as defined in this Section. Any vehicle used for critical care transport shall be equipped with an onboard AC supply capable of operating and maintaining the AC current needs of the required medical devices used in providing care during the transport of a patient.
- 5) Treatment and Transport Protocols shall address the following:
 - A) EMS System Medical Director or designee present at established Medical Control communication points and a written Expanded Scope of Practice Standard Operating Procedure signed by the EMS MD and approved for use by the Department in accordance with the System Plan;
 - B) The use of a ventilator, infusion pumps with administration of medication drips, maintenance of chest tubes, and other equipment and treatment, such as, but not limited to: arterial lines, accessing central lines, and medication-assisted intubation; and
 - C) Patient assessment and titration of IV pump medications, including additional active interventions necessary in providing care to the patient receiving treatment with advanced equipment and medications.
- 6) Quality Assurance Program
 - A) The Tier II transport provider shall develop a written QA Plan approved by the EMS System and the Department in accordance with subsection (f)(6)(D). The

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participating provider shall provide quarterly reports to the assigned EMS Resource Hospitals for the first 12 months of operation.

- B) The EMS System shall establish the frequency of quality reports after the first year if the System has not identified any deficiencies or adverse outcomes.
 - C) A Medical Director shall oversee the QA Program.
 - D) The QA Plan shall evaluate all expanded scope of practice activity for medical appropriateness and thoroughness of documentation. The review shall include:
 - i) Review of transferring physician orders and evidence of compliance with those orders;
 - ii) Documentation of vital signs and frequency, and evidence that abnormal vital signs or trends suggesting an unstable patient were appropriately detected and managed;
 - iii) Documentation of any side effects/complications, including hypotension, extreme bradycardia or tachycardia, increasing chest pain, dysrhythmia, altered mental status and/or changes in neurological examination, and evidence that interventions were appropriate for those events;
 - iv) Documentation of any unanticipated discontinuation of a catheter or rate adjustments of infusions, along with rationale and outcome;
 - v) Review of any Medical Control contact for further direction;
 - vi) Documentation that unusual occurrences were promptly communicated to the EMS System; and
 - vii) A root cause analysis of any event or care inconsistent with standards. The EMS System educator shall assess and carry out a corrective action plan.
 - E) The QA Plan shall be subject to review as part of an EMS System site survey and as deemed necessary by the Department (e.g., in response to a complaint).
- g) Tier III
Tier III provides the highest level of ground transport care for patients who require nursing level treatment modalities and interventions.
- 1) Minimum Personnel Staffing and Licensure
 - A) EMT-B/I/P (as driver); and
 - B) Two critical care prepared providers, who shall remain with the patient at all times:
 - i) Paramedic or PHRN; and
 - ii) RN.
 - 2) Education, Certification, and Experience: Paramedic or PHRN

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- A) Initial Advanced Formal Education
 - i) Approval to practice by EMS System and the Department in accordance with the EMS Program Plan;
 - ii) 80 hours established higher collegiate education or equivalent critical care education based on existing university program models; and
 - iii) Approved scope of practice more comprehensive than USDOT Curriculum and expanded scope of practice of Tier II Level.
 - B) Continuing Education Requirements
 - i) Current certifications shall be maintained;
 - ii) 12 hours of critical care level education shall be completed annually; and
 - iii) The EMS vehicle service provider shall maintain documentation of compliance with subsections (g)(2)(B)(i) and (ii) and shall provide documentation to the EMS Resource Hospital upon request.
 - C) Certifications

Tier III personnel shall maintain the following renewable critical care certifications and credentials in active status:

 - i) ACLS;
 - ii) PEPP or PALS; and
 - iii) ITLS or PHTLS.
 - D) Experience
 - i) Minimum of two years experience functioning in the field at an ALS Level;
 - ii) Documented demonstrated competencies; and
 - iii) Completion of annual competencies of expanded scope knowledge, equipment and procedures.
- 3) Education, Certification and Experience – Nurse:
- A) Continuing Education Requirements
 - i) 12 hours of critical care level education shall be completed annually;
 - ii) The EMS provider shall maintain documentation of compliance with subsection (g)(3)(A)(i) and shall provide documentation to the EMS Resource Hospital upon request; and
 - iii) Annual competencies of expanded scope of practice knowledge, equipment and procedures shall be completed.
 - B) Certifications

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Tier III personnel shall maintain the following renewable critical care certifications and credentials in active status:

- i) ACLS;
 - ii) PALS, PEPP or ENPC;
 - iii) ITLS, PHTLS, TNCC or TNS; and
 - iv) ECRN or equivalent.
- C) Advanced Certifications Preferred but not Required
- i) Certified Emergency Nurse (CEN);
 - ii) Critical Care Registered Nurse (CCRN);
 - iii) Critical Care Emergency Medical Technician-Paramedic (CCEMT-P);
 - iv) Certified Registered Flight Nurse (CFRN); and
 - v) Certified Transport Registered Nurse (CTRN).
- D) Experience
- i) Two years of experience with demonstrated competency in a critical care setting; and
 - ii) Documented demonstrated competencies.
- 4) Medical Equipment and Supplies
Tier III transport requires nursing level treatment modalities and interventions as agreed upon by the sending physician and the accepting physician at the receiving facility. If either physician is not available for consult, the provider's Medical Director or designee shall direct care.
- 5) Vehicular Standards
Any vehicle used for providing critical care transport shall comply, at a minimum, with Section 515.830 (Ambulance Licensing Requirements) or Sections 515.900 (Licensure of SEMSV Programs – General) and 515.920 (SEMSV Program Licensure Requirements for All Vehicles) regarding licensure of SEMSV programs and SEMSV vehicle requirements, including additional medical equipment and ambulance equipment as defined in this Section. Any vehicle used for critical care transport shall be equipped with an onboard AC supply capable of operating and maintaining the AC current needs of the required medical devices used in providing care during the transport of a patient.
- 6) Treatment and Transport Protocols shall address the following:
- A) Paramedic or PHRN: EMS Medical Director or designee present at established Medical Control communication points and written Critical Care Standard Operating procedure signed by the EMS MD and approved for use by the Department in accordance with the System Plan;
 - B) Registered Nurse: The provider's Critical Care Medical Director may establish standing medical orders for nursing personnel, or the RN may be approved to accept orders from the sending physician and/or receiving physician.

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- 7) Quality Assurance Program
 - A) The Tier III transport provider shall have a written QA Plan approved by the EMS System and the Department, in accordance with subsection (g)(7)(D). The provider shall provide quarterly reports to the assigned EMS Resource Hospitals for the first 12 months of operation.
 - B) The EMS System shall establish the frequency of quality reports after the first year if the System has not identified any deficiencies or adverse outcomes.
 - C) A Medical Director shall oversee the QA Program.
 - D) The QA Plan shall evaluate all expanded scope of practice activity for medical appropriateness and thoroughness of documentation. The review shall include:
 - i) Review of transferring physician orders and evidence of compliance with those orders;
 - ii) Documentation of vital signs and frequency and evidence that abnormal vital signs or trends suggesting an unstable patient were appropriately detected and managed;
 - iii) Documentation of any side effects/complications, including hypotension, extreme bradycardia or tachycardia, increasing chest pain, dysrhythmia, altered mental status and/or changes in neurological examination, and evidence that interventions were appropriate for those events;
 - iv) Documentation of any unanticipated discontinuation of a catheter or rate adjustments of infusions, along with rationale and outcome;
 - v) Review of any medical control contact for further direction;
 - vi) Prompt communication of unusual occurrences to the EMS System;
 - vii) A root cause analysis of any event or care inconsistent with standards. The EMS System educator shall assess and carry out a corrective action plan.
 - E) The QA Plan will be subject to review as part of an EMS System site survey and as deemed necessary by the Department (e.g., in response to a complaint).
- h) The Department will approve vehicle service providers for critical care transport when the provider demonstrates compliance with an approved EMS System's Critical Care Transport Program Plan for Tier II or Tier III transports. Only Department approved agencies may advertise as Critical Care Transport providers.
- i) The Department will suspend a vehicle service provider's approval for critical care transport if any part of the provider's QA plan is not followed or if a situation exists that poses a threat to the public health and safety. The Department will provide a notice of suspension of critical care transport approval and an opportunity for hearing. If the vehicle service provider does not respond to the notice within 10 days after receipt, approval will be revoked.

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- j) The Director may summarily suspend any licensed provider's authorization to perform critical care transports under this Part if the Director or designee determines that continued critical care transport by the provider poses an imminent threat to the health or safety of the public. Any order for suspension will be in writing and effective immediately upon service of the provider or its lawful agent. Any provider served with an order of suspension shall immediately cease accepting all critical care transport cases and shall have the right to request a hearing if a written request is delivered to the Department within 15 days after receipt of the order of suspension. If a timely request is delivered to the Department, then the Department will endeavor to schedule a hearing in an expedited manor, taking into account equity and the need for evidence and live witnesses at the hearing. The Department is authorized to seek injunctive relief in the circuit court if the Director's order is violated.

(Source: Added at 36 Ill. Reg. 880, effective January 6, 2012)

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Tier I

Purpose:

To provide a level of care for patients who require care beyond the paramedic scope of practice; up to but not inclusive of Critical Care Transport Status.

Definition:

- Licensed Illinois EMT-P or PHRN
- Minimum of one year experience functioning in the field at an ALS level
- Approved Scope of Practice more comprehensive than Paramedic Curriculum
- Approved to practice by IDPH and included in EMS System Plan

Staff Education:

- ACLS
- PEPP/PALS/ENCP
- ITLS/PHTLS/TNS/TNCC

Documentation of education for expanded scope skills and documented demonstrated competencies of same level of care approved by IDPH in EMS System Plan.

Staffing:

Minimum staffing shall be

- EMT/Basic as driver (may be EMT-Basic, Intermediate or Paramedic/PHRN)
- EMT-Paramedic Expanded Scope of Practice credentialed individual or PHRN who must remain in the patient compartment (at the patients side) at all times

Continuing Education:

- Annual competencies of expanded scope knowledge, equipment and procedures must be completed
- Documentation of said competencies must be maintained by the EMS agency provider and available to the EMS Resource Hospital upon request

Medical Control:

EMS System Medical Director or Designee at established Medical Control Communication Points and a written Expanded Scope of Practice Standard Operating Procedure signed by the ERMS MD and approved for use by IDPH

Equipment:

Must include but not limited to:

- Ventilator
- Infusion Pumps
- Medication Drips
- Maintenance of Chest Tubes
-

**Each agency is responsible for the education and training on all equipment that is used by their agency.

**If an agency uses loaned equipment, it is the agencies responsibility to be sure all staff that used the equipment is proficient on the use of the equipment.

Quality Assurance Program:

- Shall have a written QA Plan approved by the EMS System and IDPH
- A Registered Nurse or Medical Doctor shall oversee the QA Program
- The QA Plan shall evaluate all Expanded Scope of Practice activity for medical appropriateness and thoroughness of documentation. The review shall include:
- Review of transferring physician orders and evidence of compliance with those orders
- Documentation of vital signs and frequency and evidence that abnormal vital signs or trends suggesting an unstable patient were appropriately detected and managed

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- Documentation of any side effects/complications including hypotension, extreme bradycardia or tachycardia, increasing chest pain, dysrhythmia, altered mental status and/or changes in the neuro exam, and evidence that interventions were appropriate for these events
- Documentation of any unanticipated discontinuation of a catheter or rate adjustments of infusions along with rationale and outcome
- Review of any Medical Control contact for further direction

Right to deny Transport:

- Any agency in the PAEMS System reserves the right to deny transport under the following conditions:
 - If providing the Expanded Scope transport will impede the ability for the agency to provide emergency response within their response area due to staffing or equipment.
 - If it is deemed the patient is not stable enough for ground transport after consultation with the Medical Director or Medical Control.
 - If the safety of the patient and crew is at significant risk, (i.e. weather, road conditions, violent patients).

All pain management will be handled utilizing Peoria Area EMS System Protocols.

- Pain will be reassessed every 30 minutes during transport
- The Wong and Baker or VAS number scale will be utilized
 - Pain assessment may need to be done more often if there is change in patients condition

All cardiac events will be handled utilizing Peoria Area EMS System Protocols.

- Cardiac Monitor/EKG
- Pulse Ox
- Oxygen
- EtCo2
- Routine Vitals
 - Every 15 minutes for critical patients
 - Every 5 minutes or > if unstable

Unusual occurrences shall be communicated promptly to the EMS System.

- An incident report will be sent to the PAEMS Office within 24 hours of the event.
- The PAEMS Office will conduct an investigation of the event.
- A root cause analysis of any untoward event or care inconsistent with standards shall be conducted. Educational needs shall be assessed and carried out by the educator with direction of the system as needed
- Reports summarizing QA activity, identified trends, and resolutions shall be provided to the participating Provider and IDPH by the EMS System on a quarterly basis.

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Tier 1 Medications

Antibiotics IV

Class: Antibiotics

Action/Usage: To treat pre-existing infections or as a prophylactic measure in patients that are high risk of developing an infection or sepsis.

Complications: Allergic reactions: rash, swelling, nausea, vomiting, diarrhea, chills, fever, and laryngeal edema, anaphylaxis, leukopenia, ototoxicity, nephrotoxicity (aminoglycosides).

Adverse Reactions: Too rapid administration.

Equipment: Infusion Pump.

Standing Orders:

- Antibiotic therapy must be initiated by transferring hospital prior to transport.
- Known allergies must be assessed prior to administering the antibiotic.
- Verify drug, dose, route and time of administration from the physician order sheet.
- Infuse IV antibiotic over 30-60 minutes. Aminoglycoside antibiotics must be administered over 60 minutes unless otherwise instructed.
- An infusion pump will be used to administer the medication.
- Rate of infusion will be specified on the physicians order sheet or hospital pharmacy directions.
- Monitor for signs and symptoms of an allergic response. If any symptoms are noted, stop infusion and contact Medical Control.
- Once IV antibiotics have finished infusing, keep line open with NS or LR TKO.

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Dopamine Infusion

Class: Sympathomimetic

Trade Name: Intropin

Chemical Class: Catecholamine

Therapeutic Class: Vasopressor, α - and β -adrenergic sympathomimetic

Action: Alpha and Beta-adrenergic agonist, resulting in increased cardiac contractility and myocardial workload as well as peripheral vasoconstriction (both venous & arterial).

Indications:

- Correction of hemodynamic imbalance in hypoperfusion syndromes other than volume deficit.
- Cardiac dysfunction due to AMI
- Cardiac dysfunction due to CHF
- Poor perfusion due to sepsis
- Neurologically induced vasodilatation (neurogenic shock)
- Renal failure
- Hemodynamically significant bradycardia that does not respond to atropine and/or transcutaneous pacing

Contraindications:

- Uncontrolled tachycardia
- Ventricular irritability
- Hypertension
- Hypoperfusion from volume deficit

Complications/Adverse Reactions/Side Effects:

- Tachycardia
- Hypertension
- Ventricular irritability
- Angina
- Anxiety
- Decreased peripheral perfusion
- Tissue necrosis with infiltration of IV line

Precautions: Use with caution in the following patients:

- Patients with occlusive vascular disease (or other types of peripheral vascular insufficiency)
- Inactivated when added to sodium bicarbonate or other alkaline solutions
- Infiltration may cause necrosis and sloughing of tissue
- Patients with occlusive vascular disease may receive peripheral skin color and temperature changes from compromised circulation
- High doses may cause peripheral vasoconstriction
- LOW DOSES MAY CAUSE DECREASED BLOOD PRESSURE FROM PERIPHERAL DILATION
- Storage: Protect from light. Solutions that are darker than slightly yellow should not be used

Equipment: Infusion Pump

How Supplied:

- 400mg in 250mL D5W yielding a 1600mcg/ml concentration.
- 800mg in 250mL D5W yielding a 3200mcg/ml concentration.

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Dose:

- Dopaminergic (renal) dose: 2-5mcg/kg/min
- Beta agonist (cardiac) dose: 5-15mcg/kg/min
- Alpha agonist (vasopressor) dose: >15mcg/kg/min

Standing Orders:

- Routine ALS Care
- Verify concentration & dose, infusion rate as well as total time and vital sign parameters at the transferring facility prior to departure
- Verify patient weight (in kilograms)
- Incompatible with Sodium Bicarbonate. No IV push drugs can be administered through this IV line
- Monitor patient closely for rhythm changes en-route and repeat vital signs every 15 minutes
- Monitor urine output (should be at least 25mL/hr)
- Notify Medical Control if complications arise
- Maximum infusion of Dopamine is not to exceed 50mcg/kg/minute

Drug Interactions:

- Incompatible in alkaline solutions
- MAOIs will enhance effects of dopamine
- Beta blockers may antagonize effects of dopamine
- When administered with Phenytoin: may cause hypotension, bradycardia and seizures

Duration of Action:

- Onset: 1-4 minutes
- Peak Effect: 5-10 minutes
- Duration: Effects cease almost immediately after infusion shut off

Pregnancy Risk Factor: C

Pregnancy Considerations: Adverse events have been observed in some animal reproduction studies. It is not known if dopamine crosses the placenta.

Lactation: Excretion in breast milk unknown/use caution.

Mechanism of Action: Stimulates both adrenergic and dopaminergic receptors, lower doses are mainly dopaminergic stimulating and produce renal and mesenteric vasodilation, higher doses also are both dopaminergic and beta₁-adrenergic stimulating and produce cardiac stimulation and renal vasodilation; large doses stimulate alpha-adrenergic receptors

Pharmacodynamics/Kinetics:

Children: Dopamine has exhibited nonlinear kinetics in children; with dose changes, may not achieve steady-state for ~1 hour rather than 20 minutes, Onset of action: Adults: 5 minutes, Duration: Adults: <10 minutes .

- Metabolism: Renal, hepatic, plasma; 75% to inactive metabolites by monoamine oxidase and 25% to norepinephrine
- Half-life elimination: 2 minutes.

Excretion: Urine (as metabolites) .

Storage:

Protect from light. Solutions that are darker than slightly yellow should not be used.

Compatibility:

Stable in D₅LR, D₅¹/₂NS, D₅NS, D₅W, D₁₀W, LR, mannitol 20%, NS; **incompatible** with sodium bicarbonate 5%, and alkaline solutions or iron salts.

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Y-site administration: Compatible: Alcohol (ethyl), amiodarone, caffeine citrate, clonidine, diltiazem, dobutamine, dobutamine with lidocaine, dobutamine with nitroglycerin, dobutamine with nitroprusside, enalaprilat, epinephrine, esmolol, fentanyl, haloperidol, heparin, hydrocortisone sodium succinate, hydromorphone, labetalol, levofloxacin, lidocaine, lidocaine with nitroglycerin, lidocaine with nitroprusside, lorazepam, meperidine, methylprednisolone sodium, midazolam, milrinone, morphine, nicardipine, nitroglycerin, nitroglycerin with nitroprusside, nitroprusside, norepinephrine, ondansetron, potassium chloride, propofol, ranitidine, streptokinase, terbutaline, theophylline, vancomycin, vasopressin, vecuronium, verapamil, vitamin B complex with C, warfarin,.

Incompatible: Acyclovir, insulin (regular), thiopental. **Variable (consult detailed reference):** alteplase, cefepime, cyclosporine, furosemide, metronidazole.

Compatibility in syringe: Compatible: Caffeine citrate, doxapram, heparin, midazolam, norepinephrine, ranitidine.

Incompatible: Pantoprazole.

Dopamine Formula: Gravity

$$\frac{\text{Dose (mcg/kg/min)} \times \text{weight (kg)} \times \text{Drop Set (60gtts/mL)}}{\text{Concentration (mcg/mL)}} = \text{gtts/min}$$

Dopamine Formula: Pump

$$\frac{\text{Dose (mcg/kg/min)} \times \text{weight (kg)} \times \text{Time Factor (60min/hr)}}{\text{Concentration (mcg/mL)}} = \text{mL/hr}$$

Lexi-Comp Online.Lexi-Drugs Online. Hudson, OH: Lexi-Comp, Inc.; 09/11/2012. <http://online.lexi.com/>. Accessed September 25, 2012.

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Furosemide (Lasix)

Pharmacologic Category: Loop diuretic

Classification: diuretic, antihypertensive, and for treatment of hypercalcemia

Indications:

Acute pulmonary edema, in patients with systolic blood pressure >90 (without signs and symptoms of shock)

- Edema associated with congestive heart failure
- Hypertensive emergencies
- Post-cardiac arrest cerebral edema (increased intracranial pressure)

Dosing/Administration: Route: IV push - slow

- Adult: 20 to 80 mg IV or IM
- I.V. injections may be administered at a rate of 20-40 mg per minute.

Precautions:

- Use cautiously in patients with hepatic cirrhosis.
- In patients taking antihypertensive medications, there is an increased risk of hypotension.
- Risk of ototoxicity with higher doses.
- Use with caution in known sulfonamide sensitivity.

Contraindications: Anuria, severe progressive renal disease with increasing azotemia and oliguria; hypersensitivity to the drug, rarely used in children, pregnancy, and breast-feeding mothers.

- Hypokalemia, which may be induced, is of concern in patients on Digoxin and particularly those who have digitalis toxicity.
- Can lead to profound diuresis with resultant shock and electrolyte depletion.
 - Do not use in hypovolemic states and monitor closely.
- **Should not be used in children or pregnant women.**
- Anticipate rapid effects. Have urinal available. Unconscious patients should have a Foley catheter in place for transports. If urine is bloody, contact the physician.
- Trauma to the kidneys and urinary system makes the use of furosemide more hazardous.

Side effects and special notes:

- Onset occurs within 5 minutes of administration, peak effects occur within 30 minutes of administration.
- Possible side effects include hypotension, ECG changes, chest pain, dry mouth, hypochloremia, hypokalemia, hyponatremia, and hyperglycemia.
- Furosemide bolus should be given over 1 minute. Lung sounds should be noted before and after administration of furosemide.
- Ototoxicity: Rapid I.V. administration, renal impairment, excessive doses, hypoproteinemia, and concurrent use of other ototoxins are associated with ototoxicity.
- Photosensitivity: photosensitization may occur.
- Sulfa allergy: Chemical similarities are present among sulfonamides, sulfonyleureas, carbonic anhydrase inhibitors, thiazides, and loop diuretics (except ethacrynic acid). A risk of cross-reaction exists in patients with allergy to any of these compounds; avoid use when previous reaction has been severe. Discontinue if signs of hypersensitivity are noted.
- Geriatric Considerations: Loop diuretics are potent diuretics; excess amounts can lead to profound diuresis with fluid and electrolyte loss; severe loss of sodium and/or increase in BUN can cause confusion.
-

Pregnancy Risk Factor: C

Lactation: Enters breast milk - use caution

Peoria Area EMS System Critical Care Protocols

Mechanism of Action: Inhibits reabsorption of sodium and chloride in the ascending loop of Henle and distal renal tubule, interfering with the chloride-binding cotransport system, thus causing increased excretion of water, sodium, chloride, magnesium, and calcium.

Pharmacodynamics/Kinetics: Onset of action: Diuresis: Oral, S.L: 30-60 minutes; I.M.: 30 minutes; I.V.: ~5 minutes.

- Symptomatic improvement with acute pulmonary edema: Within 15-20 minutes; occurs prior to diuretic effect
- Peak effect: I.V.: 2 hours.

Storage: Protect from light. Exposure to light may cause discoloration; do not use furosemide solutions if they have a yellow color. Furosemide solutions are unstable in acidic media, but very stable in basic media. Refrigeration may result in precipitation or crystallization; however, resolubilization at room temperature or warming may be performed without affecting the drug's stability.

Compatibility:

Stable in D₅LR, D₅NS, D₅W, D₁₀W, D₂₀W, mannitol 20%, LR, NS.

Y-site administration:

Compatible: allopurinol, calcium gluconate, ceftazidime, epinephrine, fentanyl, heparin, hydromorphone, insulin (regular), lorazepam, magnesium sulfate, nitroprusside, norepinephrine, potassium chloride, procainamide, propofol, ranitidine, sodium bicarbonate, tobramycin.

Incompatible: azithromycin, caffeine citrate, ciprofloxacin, diltiazem, gentamicin, haloperidol, labetalol, levofloxacin, metoclopramide, midazolam, nicardipine, ondansetron, promethazine, amiodarone, dobutamine, dopamine, famotidine, meperidine, metoprolol, morphine, nitroglycerin, pantoprazole, vasopressin, vitamin B complex with C.

Compatibility in syringe: Compatible: dexamethasone sodium phosphate, fluorouracil, heparin.

Incompatible: Caffeine citrate, diphenhydramine, droperidol, meperidine, metoclopramide, thiamine.

Lexi-Comp Online.Lexi-Drugs Online. Hudson, OH: Lexi-Comp, Inc.; 09/11/2012. <http://online.lexi.com/>. Accessed September 25, 2012.

Peoria Area EMS System Critical Care Protocols

Heparin Administration

Introduction:

Heparin, which has anticoagulation effects, is used to prevent thromboembolic complications. It's administered by IV infusion or subcutaneous injection. IV infusion of unfractionated heparin is used for certain patients, such as those with atrial fibrillation or deep vein thrombosis, until effective anticoagulation can be achieved with oral anticoagulants such as warfarin.

Contraindications: Hypersensitivity to heparin or any component of the formulation (unless a life-threatening situation necessitates use and use of an alternative anticoagulant is not possible).

- Severe thrombocytopenia; uncontrolled active bleeding except when due to disseminated intravascular coagulation (DIC); not for use when appropriate blood coagulation tests cannot be obtained at appropriate intervals (applies to full-dose heparin only)

Complications: The patient receiving heparin is at risk for excessive bleeding and bruising. Other adverse effects of heparin include heparin-induced thrombocytopenia, elevated temperature, urticaria, and chills.

Precautions:

- Bleeding:
 - Monitor patient closely for signs or symptoms of bleeding. Certain patients are at increased risk of bleeding; risk factors include subacute bacterial endocarditis; congenital or acquired bleeding disorders; active ulcerative or angiodysplastic GI diseases; continuous GI tube drainage; severe uncontrolled hypertension; history of hemorrhagic stroke; or use shortly after brain, spinal, or ophthalmologic surgery or other invasive procedures including spinal tap or spinal anesthesia; concomitant treatment with platelet inhibitors; recent GI bleeding; thrombocytopenia or platelet defects; severe liver disease; hypertensive or diabetic retinopathy; renal failure; or in patients (especially women) >60 years of age.
 - Discontinue if bleeding occurs; severe hemorrhage or overdose may require protamine.

Equipment:

- IV administration set
- Premixed bag of IV heparin solution
 - 25,000 units/500 mL = 50 units/mL
 - 25,000 units/100 mL = 100 units/mL
- Programmable infusion pump (preferably a smart pump with dose-range alerts) on an IV pole
- Equipment for venipuncture (See the "Venipuncture" procedure.)
- Gloves
- IV catheter insertion equipment, as needed

Administration: I.V.: Continuous I.V. infusion: Infuse via infusion pump. If preparing solution, mix thoroughly prior to administration.

Heparin lock: Inject via injection cap using positive pressure flushing technique. Heparin lock flush solution is intended only to maintain patency of I.V. devices and is **not** to be used for anticoagulant therapy.

Dosing: Adult: Note: Many concentrations of heparin are available ranging from 1 unit/mL to 20,000 units/mL. Carefully examine each prefilled syringe or vial prior to use ensuring that the correct concentration is chosen. Heparin lock flush solution is intended only to maintain patency of I.V. devices and is not to be used for anticoagulant therapy.

Peoria Area EMS System Critical Care Protocols

Implementation:

- Verify the doctor's order; make sure that it includes the initial bolus dose, if required and initial infusion rate;
- Perform hand hygiene.
- Obtain baseline vital signs and assessment.
- Avoid distractions and interruptions when preparing and administering medication *to prevent medication administration errors.*
- Compare the medication label to the physician's order.
- Check the patient's medical record for an allergy or contraindication to the prescribed medication. If an allergy or contraindication exists, don't administer the medication and notify the physician.
- Verify that the medication is administered at the proper time, in the prescribed dose, and by the correct route *to reduce the risk of medication errors.*
- Perform hand hygiene.
- Confirm the patient's identity using at least **two** patient identifiers.
- Assess the patient's IV site for pain, redness, or swelling and aspirate for blood return *to ensure patency, if patency is in question.*
- Inspect the heparin solution container for cracks, leaks, and other damage. Check the solution for discoloration, particulates, or other loss of integrity. Don't administer the medication if its integrity is compromised. Check the date and time the solution was mixed, the concentration, and expiration date.
- If ordered, administer a heparin IV bolus following safe medication administration practices to quickly elevate the patient's PTT.
- Prime the IV tubing with the heparin solution.
- Label the solution container with the date, time, and your initials and place a label with the time on it.
- Thoroughly disinfect the IV catheter hub with an antiseptic pad using friction and allow it to dry.
- Attach the tubing to the catheter hub. Trace the tubing from the patient to its point of origin to make sure that it's attached to the proper port.
- Turn on the infusion pump and enter the desired infusion rate and volume or Confirm that the correct information (rate and volume) is displayed on the pump.

Alert: Heparin is considered a high-alert medication *because it can cause significant patient harm when used in error.* Another person in the Critical Care Transport Team must double-check certain procedure steps *to ensure safe medication administration.*

- Before beginning a heparin infusion, have another Team Member perform an independent double-check *to verify the patient's identity and make sure that the correct medication is hanging in the prescribed concentration, the medication's indication corresponds with the patient's diagnosis, the dosage calculations are correct and the dosing formula used to derive the final dose is correct, the route of administration is safe and proper for the patient, the pump settings are correct, and the infusion line is attached to the correct port.*
- After comparing results of the independent double-check with another Team Member, begin infusing the medication if no discrepancies exist. If discrepancies exist, rectify them before beginning the infusion.
- Push the RUN or START button or continue to monitor the infusion.
- Recheck the patency of the IV catheter and watch for infiltration.
- Check that all connections are secured *to prevent leaking, bleeding, and contamination.*
- Perform ongoing cardiovascular assessment and monitoring for adverse effects, including signs and symptoms of bleeding, thromboembolism, and pulmonary embolism.
- Document the procedure.

Alert: Don't administer another medication through the heparin IV line.

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Standing Orders:

- Infusion will be initiated at the transferring hospital, using hospital supplies.
- Notify Physician
 - If Platelets <100,000/m³
 - PTT>144
- If heparin is already running
 - Confirm and document initial bolus, if given.
- Heparin will be transported on an IV pump
 - Note the volume on the patient chart at the beginning and end of the transfer.
- The infusion rate should remain the same unless rate adjustment ordered by a physician with the authority to change the order.

Documentation:

Record the time the heparin was started, the concentration, the route of administration, the vascular access device used, the presence of blood return, and the name of the person who performed an independent double-check. Note the condition of the IV site. Document any changes made to the infusion rate. Document any adverse effects, pain at the administration site, bruising, or swelling. Document the date and time the infusion was complete.

Pharmacodynamics/Kinetics:

- Onset of action: Anticoagulation:
- I.V.: Immediate;
- SubQ: ~20-30 minutes

- Absorption: Oral, rectal: Erratic at best from these routes of administration; SubQ absorption is also erratic, but considered acceptable for prophylactic use.

Metabolism: Hepatic; may be partially metabolized in the reticuloendothelial system.

Half-life elimination:

Dose-dependent: I.V. bolus: 25 units/kg: 30 minutes; 100 units/kg: 60 minutes; 400 units/kg: 150 minutes (Hirsh, 2008).

Mean: 1.5 hours; Range: 1-2 hours; affected by obesity, renal function, malignancy, presence of pulmonary embolism, and infections.

Note:

At therapeutic doses, elimination occurs rapidly via nonrenal mechanisms. With very high doses, renal elimination may play more of a role; however, dosage adjustment remains unnecessary for patients with renal impairment (Hirsh, 2008).

Pregnancy Risk Factor: C

Pregnancy Considerations: Increased resorptions were observed in some animal reproduction studies. Heparin does not cross the placenta. Heparin may be used for the prevention and treatment of thromboembolism in pregnant women; however the use of low molecular weight heparin (LMWH) is preferred. Twice-daily heparin should be discontinued prior to induction of labor or a planned cesarean delivery. In pregnant women with mechanical heart valves, adjusted-dose LMWH or adjusted-dose heparin may be used throughout pregnancy or until week 13 of gestation when therapy can be changed to warfarin. LMWH or heparin should be resumed close to delivery. In women who are at a very high risk for thromboembolism (older generation prosthesis in mitral position or history of thromboembolism), warfarin can be used throughout pregnancy and replaced with LMWH or heparin near term; the use of low-dose aspirin is also recommended. Some products contain benzyl alcohol as a preservative; their use in pregnant women is contraindicated by some manufacturers; use of a preservative free formulation is recommended.

Lactation: Does not enter breast milk

Peoria Area EMS System Critical Care Protocols

Mechanism of Action: Potentiates the action of antithrombin III and thereby inactivates thrombin (as well as activated coagulation factors IX, X, XI, XII, and plasmin) and prevents the conversion of fibrinogen to fibrin; heparin also stimulates release of lipoprotein lipase (lipoprotein lipase hydrolyzes triglycerides to glycerol and free fatty acids)

Pharmacodynamics/Kinetics: Onset of action: Anticoagulation: I.V.: Immediate; SubQ: ~20-30 minutes
Absorption: Oral, rectal: Erratic at best from these routes of administration; SubQ absorption is also erratic, but considered acceptable for prophylactic use.
Metabolism: Hepatic; may be partially metabolized in the reticuloendothelial system
Half-life elimination: Dose-dependent: I.V. bolus: 25 units/kg: 30 minutes; 100 units/kg: 60 minutes; 400 units/kg: 150 minutes, Mean: 1.5 hours; Range: 1-2 hours; affected by obesity, renal function, malignancy, presence of pulmonary embolism, and infections.

Note: At therapeutic doses, elimination occurs rapidly via nonrenal mechanisms. With very high doses, renal elimination may play more of a role; however, dosage adjustment remains unnecessary for patients with renal impairment (Hirsh, 2008).

Excretion: Urine (small amounts as unchanged drug).

Compatibility: Stable in dextran 6% in dextrose, dextran 6% in NS, D₅LR, D₅¹/₄NS, D₅¹/₂NS, D₂₅W, fat emulsion 10%, ¹/₂NS, NS, Ringer's injection;

Variable stability (consult detailed reference) in D₅NS, D₅W, D₁₀W, LR, peritoneal dialysis solutions, TPN.

Y-site administration: Compatible: Acetaminophen, acyclovir, alcohol (ethyl), allopurinol, aminophylline, ampicillin, atropine, caffeine citrate, calcium gluconate, cefazolin, cefotaxime, cefotetan, ceftazidime, chlorpromazine, cimetidine, clindamycin, dexamethasone sodium phosphate, digoxin, dopamine, enalaprilat, epinephrine, esmolol, estrogens (conjugated famotidine, fenoldopam, fentanyl, furosemide, hydrocortisone sodium succinate, insulin (regular), isoproterenol, calcium, lidocaine, lorazepam, magnesium sulfate, meperidine, metoclopramide, midazolam, morphine, nitroprusside, norepinephrine, ondansetron, oxytocin, penicillin G potassium, pentazocine, potassium chloride, procainamide propofol, propranolol, ranitidine, sodium bicarbonate, terbutaline, theophylline, vasopressin, vecuronium, warfarin.

Incompatible: Alteplase, amiodarone, diazepam, doxycycline, haloperidol, levofloxacin, phenytoin, reteplase.

Variable (consult detailed reference): ceftriaxone, ciprofloxacin, diltiazem, diphenhydramine, dobutamine, droperidol, erythromycin fentanyl, gentamicin, hydromorphone, labetalol, methylprednisolone metoprolol, nifedipine, nitroglycerin, pantoprazole, promethazine, quinidine, succinylcholine, thiopental, tobramycin, TPN, vancomycin, vinorelbine.

Compatibility in syringe: Compatible: Aminophylline, amphotericin B, ampicillin, atropine, caffeine citrate, cefazolin, cefotaxime, cefoxitin, clindamycin, clonidine, digoxin, dobutamine, dopamine, epinephrine, etomidate, fentanyl, furosemide, lidocaine, methotrexate, metoclopramide, naloxone, nitroglycerin, nitroprusside, phenobarbital, piperacillin, ranitidine, succinylcholine, verapamil, vincristine.

Incompatible: Amiodarone, diazepam, droperidol, erythromycin I, gentamicin, haloperidol, hydromorphone, levofloxacin, meperidine, midazolam, promethazine, streptomycin, tobramycin, vancomycin, warfarin.

Variable (consult detailed reference): cimetidine, dimenhydrinate, morphine,

Lexi-Comp Online.Lexi-Drugs Online. Hudson, OH: Lexi-Comp, Inc.; 09/06/2012. <http://online.lexi.com/>. Accessed October 02, 2012.

Peoria Area EMS System Critical Care Protocols

Histamine H₂ Antagonist

Drug Names: ranitidine (Zantac), famotidine (Pepcid), cimetidine (Tagamet)

Mechanism of Action:

Competitive inhibition of histamine at H₂-receptors of the gastric parietal cells, which inhibits gastric acid secretion, gastric volume, and hydrogen ion concentration are reduced. Does not affect pepsin secretion, pentagastrin-stimulated intrinsic factor secretion, or serum gastrin.

Indications: Short-term and maintenance therapy of duodenal ulcer, gastric ulcer, gastroesophageal reflux disease (GERD), active benign ulcer, erosive esophagitis, and pathological hypersecretory conditions; as part of a multidrug regimen for *H. pylori* eradication to reduce the risk of duodenal ulcer recurrence

- Short-term treatment of active duodenal ulcer.
- Maintenance of healing and reduction in recurrence of duodenal ulcer.
- Long-term treatment of Zollinger-Ellison syndrome, systemic mastocytosis, postoperative hypersecretion, “short-gut” syndrome.
- Treatment of GERD to achieve acid suppression, control symptoms, and prevent complications.

Pharmacologic Category: Histamine H₂ Antagonist

Dosing: Adult: Verify transferring physicians orders prior to transport.

- Infusion must be started prior to leaving transferring hospital, utilizing hospitals stock.

Administration: I.V.

- Medication should be infused through an infusion pump.

Usual Doses:

- ranitidine (Zantac): I.V.: Intermittent bolus or infusion: 50 mg every 6-8 hours.
 - Continuous I.V. infusion: 6.25 mg/hour.
 - 150 mg of ranitidine injection is diluted in 250 mL of 5% dextrose injection or another compatible IV solution.
- famotidine (Pepcid): Solution for infusion: Administer over 15-30 minutes. I.V.: 20 mg every 12 hours.
 - I.V. push: Inject over at least 2 minutes.
 - I.V. push: Dilute famotidine with NS (or another compatible solution) to a total of 5-10 mL (some centers also administer undiluted).
 - Infusion: Dilute with D₅W 100 mL or another compatible solution.
- cimetidine (Tagamet): IV infusion: 300 mg of cimetidine is added to at least 50 mL of 5% dextrose injection or another compatible IV fluid and infused over 15–20 minutes.
 - IV injection, 300 mg of cimetidine is diluted to a total of 20 mL with 0.9% sodium chloride injection or another compatible IV solution and injected over a period of not less than 5 minutes.
 - IV infusion, 900 mg of cimetidine is added to 100–1000 mL of a compatible IV solution and infused over 24 hours; use of a controlled-infusion device (e.g., pump) is recommended when the volume to be infused over 24 hours is smaller than 250 mL.

Geriatric Considerations:

Ulcer healing rates and incidence of adverse effects are similar in the elderly, when compared to younger patients; dosing adjustments not necessary based on age alone. Always adjust dose based upon creatinine clearance. Serum half-life is increased to 3-4 hours in elderly patients. This drug is substantially cleared renally, and elderly, having decreased renal function in general, should be monitored closely for adverse effects, especially CNS.

Peoria Area EMS System Critical Care Protocols

Pregnancy Risk Factor: B

Pregnancy Considerations:

Adverse events were not observed in animal studies; therefore, ranitidine is classified as pregnancy category B. Ranitidine crosses the placenta. An increased risk of congenital malformations or adverse events in the newborn has generally not been observed following maternal use of ranitidine during pregnancy. Histamine H₂ antagonists have been evaluated for the treatment of gastroesophageal reflux disease (GERD) as well as gastric and duodenal ulcers during pregnancy. If needed, ranitidine is the agent of choice. Histamine H₂ antagonists may be used for aspiration prophylaxis prior to cesarean delivery.

Lactation: Enters breast milk. Use caution. The manufacturer recommends that caution be exercised when administering H₂ antagonist to nursing women. Peak milk concentrations occur ~5.5 hours after the dose (case report).

Adverse Reactions:

- Cardiovascular: asystole, atrioventricular block, bradycardia (with rapid I.V. administration), premature ventricular beats, tachycardia, vasculitis
- Central nervous system: agitation, dizziness, depression, hallucinations, headache, insomnia, malaise, mental confusion, somnolence, vertigo
- Dermatologic: alopecia, erythema multiforme, rash
- Endocrine & metabolic: prolactin levels increased
- Gastrointestinal: abdominal discomfort/pain, constipation, diarrhea, nausea, necrotizing enterocolitis (VLBW neonates; Guillet, 2006), pancreatitis, vomiting
- Hematologic: acquired immune hemolytic anemia, acute porphyritic attack, agranulocytosis, aplastic anemia, granulocytopenia, leukopenia, pancytopenia, thrombocytopenia
- Hepatic: cholestatic hepatitis, hepatic failure, hepatitis, jaundice
- Local: transient pain, burning or itching at the injection site
- Neuromuscular & skeletal: arthralgia, involuntary motor disturbance, myalgia
- Ocular: blurred vision
- Renal: acute interstitial nephritis, serum creatinine increased
- Respiratory: pneumonia (causal relationship not established)
- Miscellaneous: anaphylaxis, angioneurotic edema, hypersensitivity reactions (e.g., bronchospasm, fever, eosinophilia)

References: Lexi-Comp Online. Lexi-Drugs Online. Hudson, OH: Lexi-Comp, Inc.; August 2012.
<http://online.lexi.com/>. Accessed August 29, 2012.

Peoria Area EMS System Critical Care Protocols

Integrilin Infusion (Eptifibatide)

Class: Glycoprotein IIb/IIIa inhibitor

Action: Eptifibatide inhibits platelet aggregation by reversibly binding to the platelet receptor glycoprotein (GP) IIb/IIIa of human platelets, thus preventing the binding of fibrinogen, von Willebrand factor, and other adhesive ligands. Inhibition of platelet aggregation occurs in a dose- and concentration-dependent manner.

Indications:

1. Treatment of acute coronary syndrome, with or without emergent coronary intervention.
2. Treatment of those undergoing percutaneous coronary intervention.

Contraindications:

- Active abnormal bleeding within previous 30 days
- Administration of other parenteral glycoprotein IIb/IIIa inhibitors, current or planned
- History of bleeding diathesis
- Hypersensitivity to any component of product
- Major surgery within previous 6 weeks
- Renal dialysis
- Stroke, within previous 30 days
- Stroke, hemorrhagic, any history
- Uncontrolled hypertension (greater than 200 mmHg systolic or greater than 110 mmHg diastolic)

Complications/Adverse Reactions:

- Hypotension (7%)
- **Minor** Bleeding (3% to 14.2%)
- **Major** Bleeding (1.3% to 10.8%)
- Cerebral hemorrhage/Intracranial hemorrhage
- Pulmonary hemorrhage

Precautions:

- geriatric; increased risk of bleeding
- non-compressible IV sites (eg, subclavian or jugular veins); avoid use
- platelet count less than 100,000/mm³; monitoring recommended; discontinuation may be necessary
- renal insufficiency; dose adjustment recommended
- thrombocytopenia, acute, profound, has occurred; monitoring recommended, discontinuation may be necessary
- vascular and other trauma; minimize use of arterial and venous punctures, IM injections, nasogastric tubes, nasotracheal intubation, or urinary catheters

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Standing Orders:

- Routine ALS Care.
- Verify patient weight (in Kilograms).
- Verify initial dose and infusion rate at the transferring facility prior to departure.
- Verify serum creatinine level prior.
- Verify additional lab values including: platelet count, hematocrit, (HCT), hemoglobin (Hgb), PT, and PTT.
- Incompatible with furosemide (Lasix); may be administered in the same IV line as atropine, heparin, metoprolol, midazolam (Versed) morphine or nitroglycerin.
- Position the head of the cot at 30 degrees for transport.
- If a patient has a vascular catheter in the groin from the transferring hospital, that patient must remain flat. Monitor patient closely en-route. Look for signs of bleeding, intracranial hemorrhage, hypotension or allergic reaction (anaphylaxis).
- If uncontrolled bleeding, hypotension or allergic reaction develops, immediately discontinue the infusion, provide necessary treatment and contact Medical Control.

Administration/Monitoring:

- Do not shake vial . Bolus doses should be withdrawn from the 10 mL vial into a syringe and administered by IV push over 1-2 minutes.
- When using an IV infusion pump, begin continuous infusion immediately following the bolus and administer directly from the 100 mL vial; the vial should be spiked, within the circle on the stopper top, with a vented infusion set

Side Effects: Bleeding/hemorrhage, anemia, thrombocytopenia, hypotension.

Equipment: Infusion Pump.

How Supplied: Infusion: 100ml vial (0.75mg/ml)

- **Dose:** See dosing chart
- Administer undiluted directly from the 100mL vial (vial should be spiked with a vented infusion set).

Pregnancy Risk Factor: B

Pregnancy Considerations: Teratogenic effects were not observed in animal studies.

Lactation: Excretion in breast milk unknown/use caution

Pharmacodynamics/Kinetics:

- Onset of action: within 1 hour

Duration: Platelet function restored ~4 hours following discontinuation

Half-life elimination: 2.5 hours

Excretion: Primarily urine (as eptifibatid and metabolites); significant renal impairment may alter disposition of this compound

Clearance: Total body: 55-58 mL/kg/hour; renal: ~50% of total in healthy subjects

Compatibility/Stable: in NS (infusion may contain up to 60 mEq/L KCl) or D5NS (infusion may contain up to 60 mEq/L KCl).

Y-site administration: Compatible: alteplase, atropine, dobutamine, heparin, lidocaine, meperidine, metoprolol, midazolam, morphine, nitroglycerin, or verapamil. **Incompatible:** furosemide.

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Storage: Vials should be stored refrigerated at 2°C to 8°C (36°F to 46°F). Vials can be kept at room temperature for 2 months, after which they must be discarded. Protect from light until administration. Do not use beyond the expiration date. Discard any unused portion left in the vial.

Reference: Micromedex® 2.0 Healthcare Series [Internet database]. Greenwood Village, Colo: Thomson Reuters (Healthcare) Inc. Updated periodically.

Peoria Area EMS System Critical Care Protocols

Nitroglycerin Infusion

Class: Nitrate

Action: Vasodilator and vascular smooth muscle relaxant

- Reduces myocardial oxygen consumption, preload and afterload
- Metabolized by the liver
- Excreted in the urine
- Half-life of 1-4 minutes
- IV onset of action is immediate; duration is variable

Indications:

- Unstable angina pectoris if hemodynamically stable
- Congestive heart failure (CHF) in settings of acute MI that are hemodynamically stable
- Hypertensive emergencies

Contraindications:

- Sensitivity to nitrates
 - Increased ICP (e.g. head trauma, hemorrhagic stroke or other cerebral hemorrhage)
 - Uncorrected hypovolemia
- ** Use of sildenafil citrate (Viagra) within 48 hours**

Precautions: Use with caution in the following patients:

- Hepatic or renal disease
- Pericarditis
- Postural hypotension

Equipment: Infusion Pump.

How Supplied:

- 25mg in 250ml D5W.
- 50mg in 250ml D5W.

NOTE: Nitroglycerin infusions MUST be in a glass bottle with polyethylene tubing.

Adult Dosing: Dose: 5-50mcg/minute

IV dosage administration sets are used is 5 mcg/minute, with increases of 5 mcg/minute every 3–5 minutes until a blood pressure response is obtained or until the infusion rate is 20 mcg/minute.

Standing Orders:

- Routine ALS Care.
- Verify concentration & dose, infusion rate as well as total time and vital sign parameters at the transferring facility prior to departure.
- Nitroglycerin infusion should have its own IV site. No IV push drugs can be administered through this line. If absolutely necessary, NTG is compatible with heparin (and lidocaine).
- Monitor patient closely en-route and repeat vital signs every 15 minutes.
- Titrate NTG drip to effect (patient's pain relief) by increasing in 10mcg increments every 3-5 minutes until a response is noted.
- Be alert for developing hypotension. Titrate down in 10mcg increments for hypotension. Monitor vital signs every 3-5 minutes after an increase in dose.
- Notify Medical Control in the following circumstances:
 - Chest Pain re-occurs en-route
 - Vital signs deviate from the predetermined parameters set forth by the transferring hospital.

Peoria Area EMS System Critical Care Protocols

****Maximum infusion of NTG not to exceed 100mcg/minute. ****

Complications/Adverse Reactions/Side Effects:

- Hypotension, especially postural (from vasodilation)
- Dizziness/syncope (from hypotension)
- Pallor/sweating (from hypotension)
- Temporary pulsating headache (from vasodilation)
- Nausea/vomiting
- Tachycardia (in response to hypotension)
- Paradoxical bradycardia (rare)
- Rash or anaphylaxis

Pregnancy Risk Factor: C

Pregnancy Considerations:

Increased fetal mortality has been observed in animal studies using isosorbidedimonitrate and isosorbidedinitrate at doses much higher than those used in humans. Toxic effects were not observed in animal studies following topical administration of nitroglycerin. There are no adequate and well-controlled studies in pregnant women.

Lactation:

Excretion in breast milk unknown/use caution

Mechanism of Action:

Nitroglycerin forms free radical nitric oxide. In smooth muscle, nitric oxide activates guanylatecyclase which increases guanosine 3'5' monophosphate (cGMP) leading to dephosphorylation of myosin light chains and smooth muscle relaxation. Produces a vasodilator effect on the peripheral veins and arteries with more prominent effects on the veins. Primarily reduces cardiac oxygen demand by decreasing preload (left ventricular end-diastolic pressure); may modestly reduce afterload; dilates coronary arteries and improves collateral flow to ischemic regions. For use in rectal fissures, intra-anal administration results in decreased sphincter tone and intra-anal pressure.

Compatibility: Stable in D₅LR, D₅¹/₂NS, D₅NS, LR, ¹/₂NS; **variable stability (consult detailed reference)** in D₅W, NS.

Y-site administration: Compatible: Amiodarone, diltiazem, dobutamine, dobutamine with dopamine, dobutamine with lidocaine, dobutamine with nitroprusside, dopamine, dopamine with lidocaine, dopamine with nitroprusside, epinephrine, esmolol, famotidine, , fentanyl, haloperidol, hydromorphone, insulin (regular), labetalol, lidocaine, lidocaine with nitroprusside, lorazepam, midazolam, milrinone, morphine, nicardipine, nitroprusside, norepinephrine, propofol, ranitidine, theophylline, thiopental, vasopressin, vecuronium, warfarin.

Incompatible: Caffeine citrate, levofloxacin. **Variable (consult detailed reference):** Alteplase, furosemide, heparin, hydralazine, metoprolol, pantoprazole, tenecteplase.

Compatibility in syringe:

- **Compatible:** Heparin.
- **Incompatible:** Caffeine citrate, pantoprazole.

Lexi-Comp Online.Lexi-Drugs Online. Hudson, OH: Lexi-Comp, Inc.; 08/29/2012. <http://online.lexi.com/>. Accessed August 31, 2012.

Peoria Area EMS System Critical Care Protocols

Potassium Chloride (KCL)

Class:Electrolyte

Action: Participates in several physiological processes in the body including the transmission of nerve impulses, to maintain normal renal function and intracellular tonicity and the contraction of skeletal, cardiac, and smooth muscle.

Indications: Hypokalemia

Contraindications: Hyperkalemia

Complications/Adverse Reactions:

- Burning along the vein of infusion.
- Local site irritation.
- Lower extremity weakness.

Precautions:

- Alkalosis/acidosis (serum potassium levels may not represent total body potassium).
- Acidosis (risk of hyperkalemia).
- Burn patients (risk of hyperkalemia due to extensive tissue breakdown).
- Concomitant use of ACE inhibitors (inhibits aldosterone production resulting in potassium retention).
- Concomitant use of potassium-sparing diuretics (risk of hyperkalemia).
- Acute dehydration (risk of hyperkalemia).
- Chronic renal failure (risk of hyperkalemia).
- Patient's on Digoxin or suspected of having Digoxin toxicity.

Side Effect:

- Abdominal pain.
- Nausea & vomiting.
- EKG changes associated with hyperkalemia:
 - Tall, tented (peaked) T waves.
 - Depressed ST segments.
 - Prolonged PR intervals.
 - Flattened P waves.
 - Prolonged QRS & QT intervals.
 - Heart block.
 - Bigeminy.
 - V-Fib/cardiac arrest.

Equipment: Infusion Pump.

How Supplied: Potassium Chloride (KCL) should be diluted in a 1 liter bag of NS.

- KCL concentrations may not exceed 40mEq in 1 liter NS.

Dose:

Serum K < 2mEq: 20 to 40 mEq/hr(maximum 400 mEq/day).

Serum K > 2.5mEq: 10 to 15 mEq/hr(maximum 200 mEq/day).

- KCL infusion must be initiated at the transferring hospital.
- Can be run through either a central line or peripheral line.

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Standing Orders:

- Routine ALS care
- Verify initial dose, infusion rate and concentration as well as total time at the transferring facility prior to departure.
- Verify lab values (serum electrolytes, BUN & creatinine) prior to departure.
- Incompatible with atropine, Phenergan (promethazine), sodium bicarbonate and sodium nitroprusside.
- Assess IV insertion site for any redness, swelling or tenderness. If any one of these is present, stop the infusion, and discontinue the IV.
- Establish a new IV site (preferably in a forearm or antecubital vein) and restart infusion. Notify the receiving hospital of the area of the previous IV site and the reason for discontinuing the original IV.
- Monitor patient closely en-route. If signs & symptoms of hyperkalemia occur stop the infusion and contact Medical Control.
- Monitor urinary output (long-distance transports) and contact Medical Control if urinary output is <30ml/hr for two (2) consecutive hours.

Administration: IV Potassium must be diluted prior to parenteral administration. Do not administer IV push. In general, the dose, concentration of infusion and rate of administration may be dependent on patient condition and specific institution policy. The recommend maximum concentration for peripheral infusion is 10 mEq/100 mL and maximum rate of administration for peripheral infusion is 10 mEq/hour. ECG monitoring is recommended for peripheral or central infusions >10 mEq/hour in adults. Concentrations and rates of infusion may be greater with central line administration. The recommend maximum concentration for central infusion is 20-40 mEq/100 mL and maximum rate of administration for central infusion is 40 mEq/hour.

Contraindications: Hypersensitivity to any component of the formulation; hyperkalemia. In addition, solid oral dosage forms are contraindicated in patients in whom there is a structural, pathological, and/or pharmacologic cause for delay or arrest in passage through the GI tract.

Pregnancy Risk Factor: C

Breast-Feeding Considerations: Potassium is excreted into breast milk (IOM, 2004). The normal content of potassium in human milk is ~13 mEq/L. Supplementation (that does not cause maternal hyperkalemia) would not be expected to affect normal concentrations.

Mechanism of Action: Potassium is the major cation of intracellular fluid and is essential for the conduction of nerve impulses in heart, brain, and skeletal muscle; contraction of cardiac, skeletal and smooth muscles; maintenance of normal renal function, acid-base balance, carbohydrate metabolism, and gastric secretion.

Pharmacodynamics/Kinetics:

- Absorption: Well absorbed from upper GI tract.
- Distribution: Enters cells via active transport from extracellular fluid.

Excretion: Primarily urine; skin and feces (small amounts); most intestinal potassium reabsorbed

Compatibility/Stable: D5LR, D51/4NS, D51/2NS, D5NS, D5W, D10W, D20W, LR, 1/2NS, NS;

Variable compatibility: mannitol.

Y-site administration: Compatible: acyclovir, allopurinol, aminophylline, amiodarone, ampicillin, atropine, calcium gluconate, chlorpromazine, ciprofloxacin, dexamethasone sodium phosphate, digoxin, diltiazem, diphenhydramine, dobutamine, dopamine, droperidol, epinephrine, fentanyl, furosemide, gentamicin, heparin, hydralazine, insulin (regular), isoproterenol, labetalol, levofloxacin, lidocaine, lorazepam, magnesium sulfate, meperidine, morphine, nifedipine, nitroglycerin, nitroprusside, norepinephrine, ondansetron, oxytocin, procainamide, propofol, propranolol, sodium bicarbonate, succinylcholine, terbutaline, theophylline, vasopressin, warfarin.

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Incompatible: azithromycin, diazepam, phenytoin.

Variable: methylprednisolone sodium succinate, midazolam, promethazine.

Compatibility in syringe: Compatible: hydromorphone, pantoprazole, thiamine.

Incompatible: dimenhydrinate.

Lexi-Comp Online.Lexi-Drugs Online. Hudson, OH: Lexi-Comp, Inc.; 07/27/2012. <http://online.lexi.com/>. Accessed October 10/02/ 2012.

Peoria Area EMS System Critical Care Protocols

Proton Pump Inhibitor

Brand Names: pantoprazole (Protonix), esomeprazole (Nexium);

Pharmacologic Category: Proton Pump Inhibitor

Indications:

Short-term treatment (7-10 days) of patients with gastroesophageal reflux disease (GERD) and a history of erosive esophagitis; hypersecretory disorders associated with Zollinger-Ellison syndrome or other neoplastic disorders.

Dosing:

- Verify transferring physicians orders prior to transport.
- Infusion must be started prior to leaving transferring hospital, utilizing hospitals stock.
- Use at least 2 patient identifiers to verify correct patient.

- **Adult:** pantoprazole (Protonix):
 - **Prevention of rebleeding in peptic ulcer bleed** pantoprazole (Protonix)
 - I.V.:80 mg followed by 8 mg/hour infusion for 72 hours **GERD:** I.V.: 40 mg once daily for 7-10 days.
 - **Pathologic GI Hypersecretory Conditions:** (e.g., Zollinger-Ellison Syndrome):
 - 80 mg every 12 hours.
 - 80 mg every 8 hours is expected to maintain acid output <10 mEq/hour in patients requiring higher dosage.

- **Adult:** esomeprazole (Nexium): 80 mg followed by 8 mg/hour infusion for 72 hours
 - IV injection over no less than 3 minutes
 - IV infusion over 10–30 minutes

Administration: I.V.:

- Flush I.V. line before and after administration. In-line filter not required.
- 2-minute infusion: The volume of reconstituted solution (4 mg/mL) to be injected may be administered intravenously over at least 2 minutes.
- 15-minute infusion: Infuse over 15 minutes at a rate not to exceed 7 mL/minute (3 mg/minute).

Pregnancy Risk Factor: B

Breast-Feeding Considerations: Not recommended due to carcinogenicity in animal studies.

Mechanism of Action:

Proton pump inhibitor suppresses gastric acid secretion by inhibition of the H⁺/K⁺-ATPase in the gastric parietal cell. Esomeprazole is the S-isomer of omeprazole.

Compatibility: Stable in D₅W, LR, NS.

Y-site administration: Compatible: aminophylline, ampicillin, cefazolin, dopamine, furosemide, ketorolac, penicillin G potassium, potassium chloride, procainamide, vasopressin,

Incompatible: Acyclovir, amiodarone, atropine, caffeine citrate, cefotaxime, cefoxitin, ceftazidime, cefuroxime, chlorpromazine, ciprofloxacin, clindamycin, cloxacillin, cyclosporine, dexamethasone sodium phosphate, diazepam, digoxin, diphenhydramine, enalaprilat, esmolol, fluconazole, hydralazine, hydrocortisone sodium, hydromorphone, isoproterenol, labetalol, levofloxacin, lidocaine, lorazepam, mannitol, metoclopramide, moxifloxacin, multiple vitamins, naloxone, nitroprusside, norepinephrine, oxytocin, pancuronium, phenobarbital, potassium phosphate, prochlorperazine, propofol, propranolol, ranitidine, thiopental, tobramycin, trimethoprim/sulfamethoxazole, vecuronium, verapamil.

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Variable (consult detailed reference): Calcium chloride, calcium gluconate, cefazolin, ceftriaxone, dimenhydrinate, dobutamine, dopamine, epinephrine, fentanyl, furosemide, gentamicin, heparin, **insulin** (regular), magnesium sulfate, meperidine, methylprednisolone sodium succinate, metronidazole, midazolam, morphine, nitroglycerin, norepinephrine, octreotide, phenytoin, sodium bicarbonate, vancomycin.

Compatibility in syringe: Compatible: Acetazolamide, alprostadil, aminophylline, ampicillin, penicillin G sodium, piperacillin, potassium chloride, procainamide, ticarcillin/clavulanate, vancomycin, zidovudine.

Incompatible: Acyclovir, amiodarone, amphotericin B, atropine, caffeine citrate, calcium chloride, calcium gluconate, cefazolin, cefotaxime, cefoxitin, ceftazidime, ceftriaxone, cefuroxime, chlorpromazine, ciprofloxacin, clindamycin, cloxacillin, cyclosporine, dexamethasone sodium phosphate, diazepam, digoxin, dimenhydrinate, diphenhydramine, dobutamine, dopamine, enalaprilat, epinephrine, estrogens (conjugated), fentanyl, fluconazole, furosemide, gentamicin, heparin, hydralazine, hydrocortisone sodium succinate, hydromorphone, indomethacin, insulin (regular), isoproterenol, labetalol, lidocaine, lorazepam, magnesium sulfate, meperidine, meropenem, methylprednisolone sodium succinate, metoclopramide, midazolam, morphine, naloxone, nitroglycerin, nitroprusside, norepinephrine, octreotide, oxytocin, pancuronium, phenobarbital, phenytoin, piperacillin/tazobactam, potassium phosphate, prochlorperazine edisylate, propranolol, ranitidine, sodium bicarbonate, thiopental, tobramycin, trimethoprim/sulfamethoxazole, vecuronium, verapamil.

Variable (consult detailed reference): Propofol.

Lexi-Comp Online. Lexi-Drugs Online. Hudson, OH: Lexi-Comp, Inc.; August 2012. <http://online.lexi.com/>. Accessed August 29, 2012.

Peoria Area EMS System Critical Care Protocols

Total Parenteral Nutrition (TPN)

Pharmacologic Category: Caloric Agent; Intravenous Nutritional Therapy

Dosing: I.V.: Adult Nutritional supplementation

Total calories: Calculate using Harris-Benedict equation (BEE) or based on stress level as indicated below:

- Harris-Benedict Equation (BEE):
 - Females: $655.1 + [(9.56 \times W) + (1.85 \times H) - (4.68 \times A)]$
 - Males: $66.47 + [(13.75 \times W) + (5 \times H) - (6.76 \times A)]$
- Then multiply BEE x (activity factor) x (stress factor)
 - W = weight in kg; H = height in cm; A = age in years
 - Activity factor = 1.2 sedentary, 1.3 normal activity, 1.4 active, 1.5 very active
 - Stress factor = 1.5 for trauma, stressed, or surgical patients and underweight (to promote weight gain); 2.0 for severe burn patients

Stress level:

- Normal/mild stress level: 20-25 kcal/kg/day
- Moderate stress level: 25-30 kcal/kg/day
- Severe stress level: 30-40 kcal/kg/day

Administration:

- Total Parenteral Nutrition should be started prior to leaving transferring facility.
 - Ensure appropriate supplies and amount of TPN prior to leaving transferring facility. The amount of TPN should be enough for infusion throughout the entire transport.
- The Critical Care Transport Team will verify the appropriate nutritional therapy and infusion rate with transferring physician's orders prior to leaving hospital.
- An infusion pump will be used to administer the medication.
- For I.V. administration only, usually via a central venous catheter; can be administered by continuous infusion over 24 hours.
- Infuse via pump using either peripheral or central venous line.
- If the medication is interrupted and cannot be restarted, call the transferring physician for further orders.

Use: Infusion of nutrient solutions into the bloodstream to support nutritional needs during a time when patient is unable to absorb nutrients via the gastrointestinal tract, cannot take adequate nutrition orally or enterally, or have had (or are expected to have) inadequate oral intake for 7-14 days.

Compatibility: Total Parenteral Nutrition should be used on its own.

Medication Safety Issues:

Lipid-containing formulations are contraindicated in patients with hypersensitivity to fat emulsion or any component of the formulation; severe egg or legume (soybean) allergies; pathologic hyperlipidemia, lipid nephrosis, pancreatitis with hyperlipemia.

Dextrose is contraindicated in patients with hypersensitivity to corn or corn products; hypertonic solutions in patients with intracranial or intraspinal hemorrhage; glucose-galactose malabsorption syndrome.

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Monitoring Parameters:

- Glucose: In patients with diabetes or patients with glucose intolerance risk factors, monitor closely. Monitor frequently upon initiation of therapy and with any changes in insulin dose or renal function.
 - During transport monitor for signs or symptoms of hyperglycemia and or hypoglycemia.
 - Treat hyperglycemia or hypoglycemia per Peoria Area EMS System Protocols.
 - Notify the transferring physician with blood sugars that increase more than 100 mg/dl from base line at time of departure.
- Line site: Monitor for signs and symptoms of infection.

Concerns related to adverse effects:

Refeeding syndrome: Use with caution in patients at risk for refeeding syndrome. Refeeding syndrome is a medical emergency; it can consist of electrolyte disturbances (e.g., potassium, phosphorus), respiratory distress, and cardiac arrhythmias, resulting in cardiopulmonary arrest. It is usually seen in patients with long-standing or severe malnutrition; initiate cautiously; approach goals slowly.

Storage Guidelines: Consider TPN a medium-risk preparation and state that (in the absence of passing a sterility test) storage period should not exceed 30 hours at room temperature, 7 days at cold temperature, and 45 days in a solid frozen state at -20°C or colder. For patients on home TPN, multiple vitamins should be added prior to TPN administration, due to limited stability of multiple vitamins.

Disease-related concerns:

- Diabetes: use with caution in patients with diabetes or insulin resistance.
- Hepatic impairment: use with caution and limit protein in patients with hepatic disease.
- Volume overload: use with caution in patients who may be sensitive to volume overload (e.g., congestive heart failure, renal failure, hepatic failure).
- Other warnings/precautions:
 - Abrupt withdrawal: If TPN is discontinued abruptly, infuse 10% dextrose at same rate and monitor blood glucose for hypoglycemia.
 - Monitor fluid and electrolyte status carefully.

Endocrine & metabolic: fluid overload, hypercapnia, hyperglycemia, hyper-/hypokalemia, hyper-/hypophosphatemia, metabolic bone disease, nonanion gap metabolic acidosis, refeeding syndrome

Hepatic: cholestasis, cirrhosis (<1%), gallstones, increased transaminases, pancreatitis, steatosis, hypertriglyceridemia

Renal: azotemia, increased BUN

Miscellaneous: bacteremia, catheter-induced infection, exit-site infections

Lexi-Comp Online.Lexi-Drugs Online. Hudson, OH: Lexi-Comp, Inc.; 08/09/2012 <http://online.lexi.com/>. Accessed September 25, 2012.

Peoria Area EMS System Critical Care Protocols

Tier 1 Actions (determine) Equipment

Chest Tube Maintenance

Purpose: To provide guidelines for the transport of patients with chest tubes.

Precautions:

- Carefully assess the chest tube and drainage set-up before transferring the patient.
- Assess and document cases involving more than 200mL/hr of drainage.
- Consult orders to determine if mechanical suction, gravity, Heimlich valve, or clamp will be used during transport.
- The rise and fall of water level in the water seal should be documented as to its presence or absence. If absent, document lung sounds prior to transport.
- Bubbling in the absence of suction is typical indication of an air leak.

Introduction: Maintaining and troubleshooting a patient's chest tube ensures proper function and prevents infection. As part of this process, the Critical Care Transport team is responsible for making respiratory and chest tube assessments, obtaining vital signs that reflect effectiveness of therapy, identifying impending complications, and knowing the appropriate interventions to perform in response to changes in the patient's therapy.

Implementation:

- Review the doctor's orders regarding chest tube care.
- Perform hand hygiene.
- Confirm the patient's identity using at least two patient identifiers.
- Perform a comprehensive pain assessment using techniques that are appropriate for the patient's age, condition, and ability to understand.
- Administer ordered pain medication, as needed. *Relieving the patient's pain promotes comfort, which helps facilitate deep breathing and coughing.*
- Maintain sterile technique whenever you make changes in the system or alter any of the connections *to avoid introducing pathogens into the pleural space.*

For all drainage systems:

- Repeatedly note the character, consistency, and amount of drainage in the collection chamber.
- Mark/document the drainage level by documenting time and date and the drainage level on the drainage collection prior to leaving and upon arrival.
- Observe the integrity of the drainage tubing and chest tube during transport, and with any change in the patient's condition.
 - Ensure the system is intact, with no air leaks, and prevent kinks or clots from forming.
 - Document any increase in amount of drainage from the chest tube.
- Periodically check that the air vent in the system is working properly.
 - Occlusion of the air vent results in a buildup of pressure, which can cause a tension pneumothorax.
- Coil the system's tubing and secure it to the edge of the stretcher.
 - Be sure the tubing remains at the level of the patient.
 - Avoid creating dependent loops, kinks, or pressure on the tubing.
 - Avoid lifting the drainage system above the chest as fluid may flow back into the pleural space.

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Steps for a water seal-wet suction system:

- Check for fluctuation in the water-seal chamber as the patient breathes. Normal fluctuations of 2" to 4" (about 5 to 10 cm) reflect pressure changes in the pleural space during respiration.
 - To check for fluctuation when a suction system is being used, momentarily disconnect the suction system so the air vent is opened and observe for fluctuation.
- Check for intermittent bubbling in the water-seal chamber. This bubbling occurs normally when the system is removing air from the pleural cavity.
 - If bubbling isn't readily apparent during quiet breathing, have the patient take a deep breath or cough. Absence of bubbling indicates that the pleural space has sealed.
 - Check the water level in the suction-control chamber. Detach the chamber or bottle from the suction source; when bubbling ceases, observe the water level. If necessary, add sterile water to bring the level to the 20-cm line or to the ordered level. Observe the water level, if necessary, add sterile water to bring the level to the 20-cm line or to the level ordered by the physician.
- Check for gentle bubbling in the suction control chamber, which indicates that proper suction level has been reached.
 - Vigorous bubbling in this chamber increases the rate of water evaporation.

Steps for a water seal-dry suction system:

- Check the water seal level and maintain proper level.
 - To ensure that the system is being used properly and to maintain the patient's safety.
- Check for fluctuation in the water-seal chamber as the patient breathes. Normal fluctuations of 2" to 4" (about 5 to 10 cm) reflect pressure changes in the pleural space during respiration.
 - To check for fluctuation when a suction system is being used, momentarily disconnect the suction system so the air vent is opened and observe for fluctuation.
- Check for intermittent bubbling in the water-seal chamber. This bubbling occurs normally when the system is removing air from the pleural cavity.
 - If bubbling isn't readily apparent during quiet breathing, have the patient take a deep breath or cough. Absence of bubbling indicates that the pleural space has sealed.
- Check that the rotary dry suction control dial is turned to the ordered suction mark, usually –20 cm suction, and verify the appropriate indicator is present confirming the desired amount of suction.
 - In some models, an orange float appears in an indicator window. Other models indicate the correct amount of suction is being delivered when the bellows reach the calibrated triangular mark in the suction monitor bellows window.

Steps for a dry seal-dry suction system:

- Check the air leak and monitor for right-to-left bubbling and fluctuation during transfer (as symptoms warrant). Fluctuation of water in the air-leak chamber is a reflection of normal pressure changes in the pleural cavity during respirations. Bubbling indicates that air is leaving the system and is normal for the patient with a pneumothorax, but it could indicate an air leak.
- Turn the dial on the Dry Suction Control to the level of suction ordered by the provider, usually –20 cm suction, and verify the indicator* confirms the desired amount of suction is achieved.
 - *In some models, an orange float appears in an indicator window. Other models confirm level of suction achieved when the bellows reach the calibrated triangular mark in the suction monitor bellows window. Refer to the manufacturer's instructions.

Caution: Do NOT "strip" a chest tube (occlude the chest tube with one hand while quickly squeezing and moving the other hand down the tube to move fluid into the collection tubing) because intraluminal pressures can rise dangerously high, which may convert a simple pneumo-chest tube to a life-threatening pneumo-chest tube and cause tissue trauma and unnecessary discomfort.

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Routine clamping of the chest tube is NOT recommended because of the risk of tension pneumothorax:

- During patient transport, keep the chest tube collection unit below chest level.
- Don't clamp the chest tube during transport.
- Keep the chest tube collection unit in an upright position.
- If you notice air leaking from the site where the chest tube enters the chest, apply an occlusive dressing and tape on two or three sides to allow air to escape and prevent a tension pneumothorax. Closely monitor the patient and inform receiving hospital of the need for new chest tube placement on arrival.

Complications:

- Tension pneumothorax may develop from excessive accumulation of air, drainage, or both and eventually may exert pressure on the heart and aorta, causing a precipitous fall in cardiac output.
- If excessive continuous bubbling is present in the water-seal chamber, especially if suction is being used, rule out a leak in the drainage system. Try to locate the leak by cross-clamping the chest tube and collection tubing briefly at various points along its length. (The bubbling will stop when a clamp is placed between the air leak and the water seal.)
 - Begin clamping the chest tube at the insertion site of the chest and work down toward the collection unit, paying special attention to the seal around the connections.
 - If a connection is loose, push it back together and tape it securely. If you clamp along the tube's entire length and the bubbling doesn't stop, the drainage system may be cracked and need replacement.



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TROUBLESHOOTING CHEST TUBECOSTOMY TUBES		
Use this table to determine possible causes of and interventions for common chest tube problems.		
Problem	Possible causes	Intervention
Water level in the water-seal chamber not rising and falling with breathing	Clot in chest tube tubing or patient's chest	Gently pinch the tubing around the clot and gingerly milk fluid to move it into the collection chamber; repeat as needed. <i>Do NOT strip the tubing because it creates high negative pressure and can damage lung tissue.</i>
	Dependent loop or kink in patient's tube with fluid occlusion	Straighten the chest tube tubing and collection tubing along its length to its connection with the collection unit.
	Dislodgment of chest tube from patient	If the chest tube comes out accidentally, immediately apply an occlusive dressing, and tape three sides allowing air to escape. Monitor the patient closely and obtain vital signs every 10 minutes. Observe for signs and symptoms of tension pneumothorax, including hypotension, distended jugular veins, unilateral absent or decreased breath sounds, tracheal shift, hypoxemia, weak and rapid pulse, dyspnea, tachypnea, diaphoresis, and chest pain. Notify the receiving hospital of the need for new chest tube placement on arrival.
	Disconnection of chest tube from drainage system connection	If the drainage system cracks, or a tube disconnects, clamp the chest tube momentarily as close to the insertion site as possible. <i>Because no air or liquid can escape from the pleural space while the tube is clamped, observe the patient closely for signs and symptoms of tension pneumothorax while the clamp is in place.</i> As an alternative to clamping the tube, submerge the distal end of the chest tube in a container of normal saline solution to create a temporary water seal while replacing the drainage system.
	Tube clamped	Clamp only when indicated; otherwise, leave tube open.
	Chest tube drain not positioned below patient's chest	Lower chest tube drain below the level of the patient's chest to allow for gravity drainage.
	In-line connectors not properly secured, causing an air leak	Ensure in-line connectors are properly secured and sealed at all times; check for loose connections periodically.
Constant bubbling in the water-seal chamber	Air leak	To determine source of an air leak, briefly clamp the chest tube close to the insertion site and observe the water seal. If the bubbling stops, the air leak may be from the chest tube or the patient's chest. Check the chest tube and chest wall dressing for a partially withdrawn chest tube. If catheter is dislodged, follow procedure above. If bubbling continues after briefly clamping the tube, this indicates a system leak requiring system replacement.
Overfilled water-seal level (water above 2 cm limit line) or overfilled suction	Too much water in the chamber	Press and hold the negative-pressure relief valve at the top of the chest tube collection unit to vent excess negative pressure in the water-seal chamber. Release the valve when the level of the water returns to the 2-cm mark. To remove water from the suction

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control chamber		control chamber, insert syringe and withdraw excess.
Not enough water in the water-seal or suction control chamber	Evaporation versus underfill or spillage	Add additional water to the suction control chamber by temporarily turning off the suction source, removing the rubber stopper, and adding water to the desired level. Additional water may be added to the water-seal chamber with a syringe by briefly clamping the chest tube and injecting water to the desired level.
Suction control chamber isn't bubbling or is bubbling too vigorously	Possible disconnection of suction source or excessive suction pressure in the system	Ensure that the suction tubing is connected and the suction source is turned on. A constant, gentle bubbling is normal. Vigorous bubbling causes quicker evaporation. Adjust the suction control source for gentle bubbling. (lower amount)
Chest tube collection unit accidentally knocked over	Human error	Set the system upright and check the fluid levels in the water-seal and suction control chambers for proper volumes. Adjust accordingly. Most units have a baffle system that prevents fluids from mixing between chambers, allowing for proper function after placing upright again.
Patient being transported between locations	As the situation indicates	Do NOT clamp the chest tube; disconnect the suction tubing from the suction source, allowing the system to collect fluid (by gravity) or air (by water seal).

Documentation:

- Record the type of system used, amount of suction applied to the pleural cavity, presence or absence of bubbling or fluctuation in the water-seal or air leak monitor chamber (if applicable).
- Document initial amount and type of drainage, and the patient's respiratory status at the beginning and at the end of the transfer, record the frequency of system inspection; amount, color, and consistency of drainage; presence or absence of bubbling or fluctuation in the water-seal or air leak monitor chamber (if applicable).

Lippincott Williams & Wilkins, Copyright © 2012. Lippincott Nursing Procedures and skills, Online (intranet). Accessed September 27, 2010.

Peoria Area EMS System Critical Care Protocols

Continuous Positive Airway Pressure (CPAP)

Introduction:

Continuous positive airway pressure (CPAP) provides constant low-flow pressure into the airways to help hold the airway open, mobilize secretions, treat atelectasis and ease the work of breathing. CPAP is also used to treat moderate to severe obstructive sleep apnea (OSA). CPAP keeps the entire airway open, from the nares to the alveoli, increasing functional residual capacity and improving gas exchange.

- Patients receive CPAP through a high-flow generating system, which can be used in the hospital setting and can reduce or eliminate the need for intubation.
- Although CPAP has traditionally been administered through a face mask, other, more comfortable methods include the face pillow and nasal mask.
- Because of the increase in thoracic pressure, CPAP is contraindicated in patients with increased intracranial pressure, hemodynamic instability, or recent facial, oral, or skull trauma.1

Equipment:

- Nasal mask, nasal pillows, or face mask (properly sized)
- CPAP machine
- Oxygen delivery tubing
- Personal protective equipment
- Optional: oxygen source, pulse oximeter

Preparation of Equipment:

Set up the CPAP machine according to manufacturer's instructions. Position the CPAP machine so the tubing easily reaches the patient and plug in the machine. Don't plug the CPAP machine into an outlet with another plug in it, and don't use an extension cord to reach the outlet. Connect the oxygen delivery tubing to the air outlet valve on the CPAP unit, if ordered.

Implementation:

- Verify the doctor's order.
- Perform hand hygiene and use personal protective equipment, as appropriate, to prevent bacterial contamination.
- Confirm the patient's identity using at least two patient identifiers.
- Explain the procedure to the patient to decrease anxiety and increase compliance.
- Connect the flexible tubing to the mask.

Administering CPAP:

- After the administration device is correctly fitted on the patient, turn on the pressure generator.
- Turn on the CPAP unit before turning on the oxygen flow to the ordered level.
- Monitor the patient's pulse oximetry/Capnography during the transport
- Clean the equipment according to facility policy and store it properly.
- Remove and discard your personal protective equipment and perform hand hygiene.
- Document the procedure.
- Inline nebulization may be utilized with CPAP in place

Special Considerations:

- If the mask isn't properly fitted, the patient may complain of dry or sore eyes. If this is the case, readjust the mask and headgear to minimize leaks.
- The patient may need to use a humidifier with the CPAP unit if he complains of a runny nose or dryness or burning in his nose and throat. Discuss this option with the doctor and obtain an order for humidification.
- Always make sure there's air coming out of the unit when the power is turned on.
- Because CPAP via a mask can cause nausea and vomiting, it shouldn't be used in a patient who's unresponsive or at risk for aspiration.

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Complications:

- CPAP potentially causes decreased cardiac output due to increased intrathoracic pressure.
 - Monitor patients' vital signs for fall in patients' blood pressure.
 - Deterioration on CPAP ⇒ mechanical ventilation/intubation
 - Deterioration of mental status
 - Increase of the EtCO₂
 - Decline of SpO₂
 - Progressive fatigue
- Other complications include nosebleeds, abdominal bloating, and headaches.
- Most complications result from ill-fitting masks, such as dry eyes, runny or dry nose, or burning in the throat or nose.

When taking a patient that is on oxygen, the Critical Care Transport Team will check to be sure that the ambulance has enough oxygen on board to assure that there is no chance of running out of oxygen on the return trip with the patient in back.

- Also taking into effect weather, construction, and vehicle breakdowns.
- The following will be used to assure enough oxygen.

Tank Factors:

- **D: 0.16**
- **M: 1.56**
- **H: 3.14**

I. Liters Per Minute:

$$\frac{(\text{PSI in Tank} - 200 \text{ PSI}) \times \text{Tank Factor}}{\text{Flow rate in LPM}}$$

This calculates the number of minutes of oxygen remaining in your tank

Documentation:

Document the CPAP settings, the length of time the patient was on the CPAP, how the patient tolerated the CPAP, and if there were any complications. Also record any patient teaching provided.

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Peoria Area EMS System Critical Care Protocols

Mechanical Ventilation, positive pressure: A mechanical ventilator moves air in and out of a patient's lungs. Although the equipment serves to ventilate a patient, it doesn't ensure adequate gas exchange. Mechanical ventilators may use either positive or negative pressure to ventilate patients.

Positive-pressure ventilators cause inspiration by forcing air into the lungs and increasing tidal volume (V_T). The inspiratory cycles of these ventilators may vary in volume, pressure, time, or frequency. For example, a volume-cycled ventilator—the type most commonly used—delivers a preset volume of air each time, regardless of the amount of lung resistance and airway pressure. A pressure-cycled ventilator generates flow until the machine reaches a preset airway pressure regardless of the volume delivered or the time required to achieve the pressure. A time-cycled ventilator generates flow for a preset amount of time. A high-frequency ventilator uses high respiratory rates and low V_T to maintain alveolar ventilation.

Equipment:

- Oxygen source
- Air source that can supply 50 psi
- Mechanical ventilator
- Humidifier
- Ventilator circuit tubing, connectors, and adapters
- Condensation collection trap
- Gloves
- Handheld resuscitation bag with reservoir
- Suction equipment
- Sterile distilled water
- Soft restraints, if indicated
- Oximeter, capnography device
- Oral care products
- Optional: chlorhexidine oral care product, as prescribed

Preparation of Equipment:

Follow the manufacturer's instructions for setting up the type of ventilator being used. In most cases, you'll need to add sterile distilled water to the humidifier and connect the ventilator to the appropriate gas source. Plug the ventilator into the electrical outlet, and turn it on. Adjust the settings on the ventilator, per physicians order. Make sure the ventilator's alarms are set, as ordered, and that the humidifier is filled with the sterile distilled water, if being used. Attach a capnographic device to measure carbon dioxide levels to confirm placement of the endotracheal (ET) tube, detect disconnection from the ventilator, and detect complications.

MECHANICAL VENTILATION GLOSSARY:

Assist-control mode: The ventilator delivers a preset tidal volume at a preset rate; however, the patient can initiate additional breaths, which trigger the ventilator to deliver the preset tidal volume at positive pressure.

Continuous positive airway pressure (CPAP): A setting that prompts the ventilator to deliver positive pressure to the airway throughout the respiratory cycle. It works only on patients who can breathe spontaneously.

Control mode: The ventilator delivers a preset tidal volume at a fixed rate regardless of whether the patient is breathing spontaneously.

Fraction of inspired oxygen (FiO₂): The percentage of oxygen delivered to the patient by the ventilator. The dial or digital display on the ventilator that sets this percentage is labeled by the term oxygen concentration or oxygen percentage.

Inspiratory-expiratory (I:E) ratio: This ratio compares the duration of inspiration to the duration of expiration. The I:E ratio of normal, spontaneous breathing is 1:2, meaning that expiration is twice as long as inspiration.

Inspiratory flow rate (IFR): The IFR denotes the tidal volume delivered within a certain time. Its value can range from 20 to 120 L/minute.

Minute ventilation or minute volume (VE): This measurement results from the multiplication of respiratory rate and tidal volume.

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Implementation:

- Verify the doctor's order.
- Verify the settings are the same as physicians order,
- Perform hand hygiene.
- Confirm the patient's identity using at least two patient identifiers.
- When possible, explain the procedure to the patient and his family *to help reduce anxiety and fear*. Assure the patient and his family that staff members are nearby to provide care.
- Make sure the patient is being adequately oxygenated.
- Put on gloves and other personal protective equipment as needed.
- As the patient's condition allows, perform a complete physical assessment.
- Observe for chest expansion, and auscultate for bilateral breath sounds to verify that the patient is being ventilated. Monitor the patient's pulse oximetry.
- Use waveform capnography, an exhaled-carbon dioxide detector device, to confirm ET tube placement.
- Hyperoxygenate the patient when needed with 100% oxygen for 30 to 60 seconds before suctioning, when needed. Suction the patient with a closed-suction catheter, if available, and limit the suctioning event to 15 seconds. After suctioning, hyperoxygenate the patient for at least 1 minute using the same technique as you did before suctioning.
- Check the ventilator tubing frequently for condensation, which can cause resistance to airflow and which may also be aspirated by the patient. As needed, drain the condensate into a collection trap. Keep the circuit closed during condensate drainage to prevent bacterial contamination. Don't drain the condensate into the humidifier because the condensate may be contaminated with the patient's secretions. Also avoid accidental drainage of condensation into the patient's airway when moving the tubing or the patient.
- When monitoring the patient's vital signs, count spontaneous breaths as well as ventilator-delivered breaths.
- Provide emotional support to the patient during all phases of mechanical ventilation to reduce his anxiety and promote successful treatment. Even if the patient is unresponsive, continue to explain all procedures and treatments to him.
- Make sure the ventilator alarms are on at all times. These alarms alert staff to potentially hazardous conditions and changes in patient status.
- Unless contraindicated, turn the patient from side to side every 1 to 2 hours to facilitate lung expansion and removal of secretions.
- Elevate the head of the bed 30 to 45 degrees, unless contraindicated, to promote air exchange and prevent ventilator-associated pneumonia. If the patient is unable to bend at the hip, maintain the patient in reverse Trendelenburg position.
- Assess the patient's peripheral circulation, and monitor his intake and output to assess for signs of decreased cardiac output. Watch for signs and symptoms of fluid volume excess or dehydration.
- Establish a method of communication, such as a communication board, because intubation and mechanical ventilation impair the patient's ability to speak.
- Administer a sedative or neuromuscular blocking agent and sedative, as ordered, following safe medication administration practices to relax the patient or eliminate spontaneous breathing efforts that can interfere with the ventilator's action.
- Remember that the patient receiving a neuromuscular blocking agent requires close observation because of his inability to breathe or communicate. .
- Document any procedure performed on the patient.

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RESPONDING TO VENTILATOR ALARMS		
SIGNAL	POSSIBLE CAUSE	INTERVENTIONS
Low-pressure Alarm	Tube disconnected from ventilator	Reconnect the tube to the ventilator.
	Endotracheal (ET) tube displaced above vocal cords or tracheostomy tube extubated	Check tube placement and reposition if needed. If extubation or displacement has occurred, ventilate the patient manually and call the doctor immediately.
	Leaking tidal volume from low cuff pressure (from an underinflated or ruptured cuff or a leak in the cuff or one-way valve)	Listen for a whooshing sound around the tube, indicating an air leak. If you hear one, check cuff pressure. If you can't maintain pressure, call the doctor.
	Ventilator malfunction	Disconnect the patient from the ventilator and ventilate him manually if necessary. Obtain another ventilator.
	Leak in ventilator circuitry (from loose connection or hole in tubing, , or cracked humidification device)	Make sure all connections are intact. Check for holes or leaks in the tubing and replace if necessary. Check the humidification device and replace if cracked.
High-pressure Alarm	Increased airway pressure or decreased lung compliance caused by worsening disease	Auscultate the lungs for evidence of increasing lung consolidation, barotrauma, or wheezing. Call the doctor if indicated.
	Patient biting on oral ET tube	Insert a bite block if needed. Consider pain medication or sedation if appropriate.
	Secretions in airway	Look for secretions in the airway. To remove them, suction the patient or have him cough.
	Condensate in large-bore tubing	Check tubing for condensate and remove any fluid.
	Intubation of right mainstem bronchus	Auscultate the lungs for evidence of diminished or absent breath sounds in the left lung fields.
	Patient coughing, gagging, or attempting to talk	Check tube position. If it has become displaced, call the doctor.
	Chest wall resistance	If the patient's breathing is asynchronous with the ventilator, check the physicians order for a sedative or neuromuscular blocking agent.
	Failure of high-pressure relief valve	Reposition the patient to see if doing so improves chest expansion. If repositioning doesn't help, administer the prescribed analgesic.
	Bronchospasm	Assess the patient for the cause. Report to the doctor, and treat as ordered.

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Special Considerations

- If an alarm sounds and the problem can't be identified easily, disconnect the patient from the ventilator and use a handheld resuscitation bag to ventilate him. (See *Responding to ventilator alarms.*)
- If the patient is receiving a neuromuscular blocking agent, make sure he also receives a sedative. Neuromuscular blocking agents cause paralysis without altering the patient's level of consciousness (LOC). Reassure the patient and his family that the paralysis is temporary. Also make sure emergency equipment is readily available in case the ventilator malfunctions or the patient is extubated accidentally. .
- In the postoperative patient, assess for pain, and administer analgesics, as needed and ordered following safe medication administration practices.
- If the patient is receiving enteral feedings, avoid gastric over distention to reduce the risk of aspiration.

Complications:

Mechanical Ventilation can cause tension pneumothorax, decreased cardiac output, oxygen toxicity, fluid volume excess caused by humidification, infection, and such GI complications as distention or bleeding from stress ulcers.

Documentation:

Name the type of ventilator used for the patient, and note its settings. Describe the patient's subjective and objective response to mechanical ventilation, including vital signs, breath sounds, neurologic status, use of accessory muscles, intake and output, and weight. List any complications and actions taken. Record all pertinent laboratory data, including ABG analysis results and oxygen saturation levels if. Document interventions such as head of bed elevation, oral care, sedation or comfort measures done during the transport. Document the patient's response to these interventions. Also, document any patient teaching provided.

List all complications and interventions done.

Call transferring physician, Medical Control, or Peoria Area EMS Medical Director with any questions or concerns of the patient's condition.

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