Base Hospital

Adult Medical Directives

For Primary Care Flight Paramedics
Advanced Care Land Paramedics
Advanced Care Flight Paramedics
Critical Care Paramedics

May 2021
BH-ADULT MD-001 R4

This document has been approved by the Medical Advisory Committee (MAC), signed by the Chair of the MAC and issued by the Director, Base Hospital.

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Authorization for Delegation of Medical Directives

The Medical Directives contained in this handbook has been approved for use by Paramedics certified with the Ornge Base Hospital.

Delegation of these Medical Directives is under the direction of Dr. Bruce Sawadsky, Medical Director, in conjunction with Associate Medical Directors Dr. Michael Lewell, Dr. Sean Moore, Dr. Michael Peddle, and Dr. Fuad Alnaji.

The Ornge Base Hospital wishes to recognize, and sincerely thank, all of the physicians, Paramedics, educational and operational staff, and external content experts as well as the BH personnel who provided input and recommendations towards the many drafts circulated over the course of the project.

Dated:	May 18, 2021
Authorized by:	Bruce Sawadsky, Medical Director Ornge Base Hospital
Signature:	
Dated:	May 18, 2021
Issued by:	Richard Yelle, Director Ornge Base Hospital
Signature:	

Revision Record

Revision No.	Revision Date	Date Entered	Entered By
0 (Original)	30 November 2016		
1	18 January 2017	13 February 2017	J. Smith
2	25 July 2017	25 July 2017	J. Smith
3	31 May 2018	18 June 2018	J. Smith
4	15 October 2019	15 October 2019	I. Quevedo
5	3 April 2020	3 April 2020	I. Quevedo
6	May 18, 2021	July 19, 2021	I. Quevedo

Future content change will be identified throughout the manual with the use of a sidebar and noted in the List of Effective Pages.
New or obsolete Medical Directives will be included in the Change Details below:

Date:	Change Details: Removed/Added
15 Oct 19	Added: Emergency Tracheostomy Tube Reinsertion (Airway)
15 Oct 19	Added: Adult High Flow Nasal Cannula Therapy (Respiratory)
15 Oct 19	Added: Inhaled Epoprostenol (Respiratory)
15 Oct 19	Moved: Agitated/Combative Patient (Neurological to Analgosedation & Paralysis)
15 Oct 19	Added: Intraosseous Vascular Access Analgesia (IV/IO and Arterial Lines)
15 Oct 19	Added: Epinephrine 1:100 000 (Shock States)
3 Apr 20	Added: Transport of Patients in the Prone Position (Respiratory)

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Preamble

This updated version of the Ornge Medical Directives (MD) has been reviewed and modified by the Medical Advisory Committee (MAC), Ornge Base Hospital (BH) personneland Paramedic Standards.
It is the responsibility of each Primary Care Flight Paramedic/PCP(f), Advanced Care Land Paramedic/ ACP(L), Advanced Care Flight Paramedic/ACP(f), Critical Care Paramedic/CCP and to identify the skill sets that he/she is not as yet certified to perform or their full or provisional status to the Transport Medicine Physician or Transport Medicine Paediatrician (TMP) during contact.
The Adult TMPs will be responsible for clinical care of all patients eighteen years of age and older (≥ 18 years) while the Transport Medicine Paediatricians will be responsible for patients UNDER eighteen years of age (< 18 years). The Adult TMP acts as a backup in the event that the Transport Medicine Paediatrician on call is not available. There is also an adult TMP on backup call should the primary on call TMPs not be available.

Definitions and Points of Interest:

≥ PCP(f) or Paramedics	Refers to all scopes - PCP(f), ACP(f), CCP
≥ ACP (L)	Refers to ACP(L), ACP(f), CCP
≥ ACP(f)	Refers to ACP(f), CCP
≥ CCP	Refers to CCP

Adult MD apply to: greater than and equal to 18 years of age –or– greater than 40 kg weight (unless stipulated on the algorithm)

Paediatric MD apply to: less than 18 years of age –or– less than or equal to 40 kg weight (unless stipulated on the algorithm)

Predicted Body Weight and Tidal Volumes Charts have been provided in the Drug Monographs and References document

Stat patch: A patch that requires immediate TMP contact in a patient in extremis requiring immediate intervention with clinical interventions not permitted without a patch within the MDSOs. Paramedics should utilize the stat patch line options in these circumstances.

Ornge Clinical Practice Guidelines

Selected guidelines have been developed for management of patients in the transport setting, using current best practice and best available evidence. References for these guidelines can be found in the Drug Monographs and References document.

Certification in this document

The Medical Directives, like all other Ornge publications, will be revised and updated on a regular basis.
The Medical Directives will be the most reliable source of information when it comes to patient care. The Drug Monographs may include generic pharmaceutical information.

General Structure of a Medical Directive

All Medical Directives follow the same format and are comprised of the following sections:

Indication: The general medical complaint or problem to which the medical directive applies.

Contraindications: Clinical parameters that if present, preclude the performance of a procedure or the administration of a drug.

Treatment: Description of the type of procedure to be performed or the dosing of a drug.

Clinical Considerations: Key clinical points that provide general guidance to the proper performance of a procedure or the adminstration of a medication.

Patch Point: A treatment option that requires prior authorization by the Transport Medicine Physician (TMP).

No PATCH	No patch is required by the Paramedic
Initiate then PATCH	Initiate treatment, then patch to the TMP
Mandatory PATCH	Mandatory patch required to the TMP prior to initiating treatment

Scope of Practice:

The Medical Directives have been formulated to incorporate most of Ornge's 4 scopes of practice within each one, therefore the Paramedic is responsible to practice within their authorized category at all times. Additional ("Auxiliary") skills may be delegated through use of the Auxiliary Medical Directives. Delegation of Auxiliary Medical Directives by the Medical Director to Paramedics is optional and may be introduced after consultation and mutual agreement between the MAC and the Service Operator that employs the Paramedic.

Patch Information:

Crews are encouraged to patch at any time. When possible, a two/three way patch while enroute to the patient should be done in order to minimize in hospital times with a stable patient or to help facilitate the transport of time sensitive patients.

Patch Format: All patches should be presented using the SBARR format outlined below

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Adult Medication and Procedure Lists

Adult Medication List

Medication	PCP(f)	ACP(L)	ACP(f)	CCP	Critical Care Resident
3% Saline			✓	✓	≥CCR2
Abciximab			✓	✓	≥CCR3
Acetaminophen	✓	✓	✓	✓	✓
Acetylcysteine Sodium			✓	✓	≥CCR3
Acetylsalicylic Acid	✓	✓	✓	✓	✓
Activated Charcoal			✓	✓	≥CCR3
Acyclovir			✓	✓	≥CCR3
Adenosine		✓	✓	✓	✓
Amiodarone		✓	✓	✓	✓
Ampicillin			✓	✓	≥CCR3
Atropine		✓	✓	✓	✓
Betamethasone			✓	✓	≥CCR3
Bivalirudin			✓	✓	≥CCR2
Calcium Chloride			✓	✓	≥CCR3
Calcium Gluconate		✓	✓	✓	✓
Cefazolin			✓	✓	≥CCR3
Ceftriaxone			✓	✓	≥CCR3
Cisatracurium				✓	≥CCR4
Clopidogrel			✓	✓	≥CCR2
Cyproheptadine				✓	≥CCR3
D10/25/50W		✓	✓	✓	✓
Dexamethasone			✓	✓	≥CCR3
Diazepam (IV & PR)			✓	✓	≥CCR3
Digitalis				✓	≥CCR4
diLTIazem				✓	≥CCR4
dimenhyDRINATE (IV)		✓	✓	✓	✓
dimenhyDRINATE (PO & IM)	✓	✓	✓	✓	✓
diphenhyDRAMINE	✓	✓	✓	✓	✓
DOBUTamine				✓	≥CCR4
DOPamine		✓	✓	✓	✓
EPINEPHrine (IM & Nebulized)	✓	✓	✓	✓	✓
EPINEPHrine (IV Push ONLY for cardiac arrest - ACLS and Neonatal Resuscitation)		✓	✓	✓	✓
EPINEPHrine (IV Push in Non-Arrest & IV Infusion)				✓	≥CCR4
Epoprostenol				✓	≥CCR4
Eptifibatide			✓	✓	≥CCR2
Ergonovine				✓	≥CCR3
Esmolol HCL				✓	≥CCR4
Etomidate				✓	≥CCR2

Adult Medication List (continued)

Medication	PCP(f)	ACP(L)	ACP(f)	CCP	Critical Care Resident
fentaNYL		✓	✓	✓	≥CCR1
Flumazenil			✓	✓	≥CCR3
Folic Acid			✓	✓	≥CCR3
Fomepizole			✓	✓	≥CCR3
Fosphenytoin			✓	✓	≥CCR3
Furosemide			✓	✓	≥CCR2
Gentamycin			✓	✓	≥CCR3
Glucagon (IM)	✓	✓	✓	✓	✓
Glucagon (IV)			✓	✓	≥CCR3
Haloperidol			✓	✓	≥CCR3
Hemabate				✓	≥CCR3
Heparin			✓	✓	≥CCR2
hydrALAZINE				✓	≥CCR4
Ibuprofen	✓	✓	✓	✓	✓
Insulin			✓	✓	≥CCR3
Intralipid				✓	≥CCR4
Ipratropium Bromide			✓	✓	≥CCR1
Isoproterenol				✓	≥CCR4
Kayexalate			✓	✓	≥CCR3
Ketamine			✓	✓	≥CCR1
Labetalol			✓	✓	≥CCR3
Lidocaine (IV & Topical)		✓	✓	✓	✓
LORazepam			✓	✓	≥CCR2
Magnesium Sulphate			✓	✓	≥CCR3
Mannitol 20%			✓	✓	≥CCR2
methylPREDNISolone ACEtate			✓	✓	≥CCR3
Metoprolol			✓	✓	≥CCR2
Metronidazole			✓	✓	≥CCR3
Midazolam		✓	✓	✓	✓
Milrinone				✓	≥CCR4
Morphine Sulphate		✓	✓	✓	✓
Naloxone (IM)	✓	✓	✓	✓	✓
Naloxone (IV)		✓	✓	✓	✓
niFEDIPine			✓	✓	≥CCR3
Nitroglycerin (IV & Topical)			✓	✓	≥CCR2
Nitroglycerin (SL)	✓	✓	✓	✓	✓
Norepinephrine			✓	✓	≥CCR1
Octaplex			✓	✓	≥CCR3

Adult Medication List (continued)

Medication	PCP(f)	ACP(L)	ACP(f)	CCP	Critical Care Resident
Octreotide			✓	✓	≥CCR3
Ondansetron			✓	✓	≥CCR1
Oxytocin			✓	✓	≥CCR3
Pantoprazole			✓	✓	≥CCR3
PHENObarbital				✓	≥CCR4
Phentolamine			✓	✓	≥CCR2
Phenylephrine				✓	≥CCR3
phenyTOIN			✓	✓	≥CCR3
Potassium Chloride (Premix IV sol'n ONLY)	✓	✓	✓	✓	✓
Potassium Chloride (added into IV sol`n)			✓	✓	≥CCR3
Pralidoxime			✓	✓	≥CCR3
Procainamide				✓	≥CCR4
Propofol				✓	≥CCR3
Prothrombin Complex Concentrate / Octaplex			✓	✓	≥CCR3
Pyridoxine			✓	✓	≥CCR3
Rocuronium			✓	✓	≥CCR2
Salbutamol (IV)				✓	≥CCR4
Salbutamol (Nebulized & MDI)	✓	✓	✓	✓	✓
Sodium Bicarbonate			✓	✓	≥CCR3
Succinylcholine				✓	≥CCR2
Thiamine			✓	✓	≥CCR3
Ticagrelor			✓	✓	≥CCR2
Tirofiban			✓	✓	≥CCR2
TNKase			✓	✓	≥CCR2
Tobramycin			✓	✓	≥CCR3
Toradol (IM)	✓	✓	✓	✓	✓
Tranexamic Acid (TXA)			✓	✓	≥CCR2
Vancomycin			✓	✓	≥CCR3
Vasopressin				✓	≥CCR4
Vecuronium			✓	✓	≥CCR4
Vitamin K			✓	✓	≥CCR3
Xylometazoline		✓	✓	✓	≥CCR1
	PCP(f) Primary Care Flight Para-medic	ACP Advanced Care Paramedic	ACP(f) Advanced Care Flight Para-medic	CCP Critical Care Paramedic	

The CCP and may administer any medication under the direction of the TMP provided that they are familiar with the drug and comfortable with managing its administration and potential side effects.

Critical Care Residents can perform to the scope of practice noted in this document while working with a Field Training Officer/ Field Educator.

Adult Procedure List

Legend: M- Monitoring, I- Initiation (includes troubleshooting), T- Troubleshooting (includes monitoring)

Procedures	PCP(f)	ACP(L)	ACP(f)	CCP	Critical Care Resident
Arterial line monitoring (transduce & blood sampling)			T	T	≥CCR1
Advanced Airway Management: Bougie, Direct or Video Laryngoscopy (VL)		I	I	I	I
Balloon tamponade of gastroesophageal varices monitoring (Blakemore tubes)				M	≥CCR3
Bimanual uterine massage				I	≥CCR3
NPPV			I	I	≥CCR1
Blood analysis (iSTAT)			I	I	≥CCR1
Blood product transfusion			I	I	≥CCR2
Blood sampling-Peripheral venous and capillary			I	I	≥CCR1
Brandt maneuver				I	≥CCR3
Cardiac ECG monitoring and interpretation - Lead II, 12-lead STEMI recognition	I	I	I	I	I
Cardiac ECG monitoring and interpretation - All leads including 12 & 15		I	I	I	I
Chest drainage systems			T	T	≥CCR1
Chest x-ray or CXR interpretation			I	I	≥CCR1
Doppler ultrasound assessment			I	I	≥CCR3
$ETCO_2$ capnography (intubated & non-intubated patients)		I	I	I	I
External defibrillation - Semi-automatic	I	I	I	I	I
External defibrillation - Manual		I	I	I	I
Field extubation		I	I	I	I
Foreign body removal (with McGill forceps)		I	I	I	I
Gastric intubation	M	M	I	I	M
Intra-aortic balloon pump monitoring				T*	
Intraosseous (IO) Initiation		I	I	I	I
Intubation - Nasotracheal		I	I	I	I
Intubation - Orotracheal		I	I	I	I
Intravenous initiation (peripheral, external jugular & infant scalp vein)		I	I	I	I
Lab value interpretation			I	I	≥CCR1
Manometer for positive pressure ventilation	I	I	I	I	I
Mechanical ventilation for patients weighing ≤ 5 kg				I	≥CCR4
Mechanical ventilation for patients weighing > 5 kg			I	I	≥CCR1
Multi-channel infusion pump/syringe [1]		I	I	I	≥CCR1
Needle cricothyrotomy		I	I	I	I
Needle thoracostomy		I	I	I	I
Emergency Medical Childbirth	I	I	I	I	I

Adult Procedure List (continued)

Procedures	PCP(f)	ACP(L)	ACP(f)	CCP	Critical Care Resident
Pacing - Transcutaneous		I	I	I	≥CCR4
Pacing - Transvenous				T	≥CCR4
Pulmonary artery catheter monitoring and/ or removal				I*	
Rapid Sequence Intubation or RSI				I	≥CCR2
Reverting uterine inversion				I	≥CCR3
Suctioning (Endotracheal, Tracheostomy)	I	I	I	I	I
Supraglottic Airway (SGA)	I	I	I	I	I
Synchronized cardioversion		I	I	I	I
Tracheostomy care: Maintenance & Emergency Reinsertion/ Intervention	I	I	I	I	I
Transport Isolette - Care of a neonate			I	I	≥CCR3
Umbilical vein catheterization or UVC			I	I	≥CCR3
Urinary catheterization	M	M	I	I	≥CCR1
Vascular access - Arterial stab					
Vascular access - Central venous catheter	M	M	M	M	
Vascular access - Peripheral venous and Capillary		I	I	I	
	PCP(f) Primary Care Flight Para-medic	ACP Advanced Care Paramedic	ACP(f) Advanced Care Flight Para-medic	CCP Critical Care Paramedic	

*selected CCP only

[1] ACP Land: Initiation for DOPamine ONLY

Airway

Ornge Airway Manual-Executive Summary

Version 1.02: January 28, 2016

Rationale

Working in the transport setting provides a challenging work place environment. Critically unstable patients require advanced care, including intubation, in challenging and unfamiliar contexts. The process of intubating patients in unfamiliar and dynamic settings is complex and many factors potentially contribute to the potential of an airway failure. These include but are not limited to poor optimization prior to induction, equipment failure, poor communication, and human error during the intubation process. The goal is to outline a consistent, structured approach to the rapid sequence induction and intubation of a patient. The adoption of a streamlined, universal, evidenced based approach to the airway will ensure that any two paramedics are comfortable and familiar with the intubation process. This standardized approach will ensure a streamlined efficient intubation process, minimizing failure and planning in advance should failure arise.

Definitions

Intubation attempt: An intubation attempt is defined as the insertion of a laryngoscope or the insertion of any bougie or airway device past the lips for the purpose of securing the airway. First attempt success is not disqualified by necessary adjustments to the depth of the ETT or re-securing it.

Rapid Sequence Induction (RSI): An advanced airway procedure used to achieve endotracheal intubation using a paralytic and an induction agent.

Crash Intubation: Attempted endotracheal intubation without the use of pretreatment, induction or paralytic in the moribund patient.

Sedation Facilitated Intubation (SFI): Attempted intubation using a topical anesthetic and sedative or dissociative agent.

Organizational Goals:

- Successful intubation on first airway attempt
- No desaturation (SpO2 <90%)
- No hypotension (SBP <90 mmHg)(MAP < 65)
- No other airway complications
  - Vomiting/Aspiration
  - Hypoventilation
  - Airway trauma caused by intubator
  - Misplacement of tracheal tube
  - Bradycardia
  - Cardiac arrest

Benchmarks

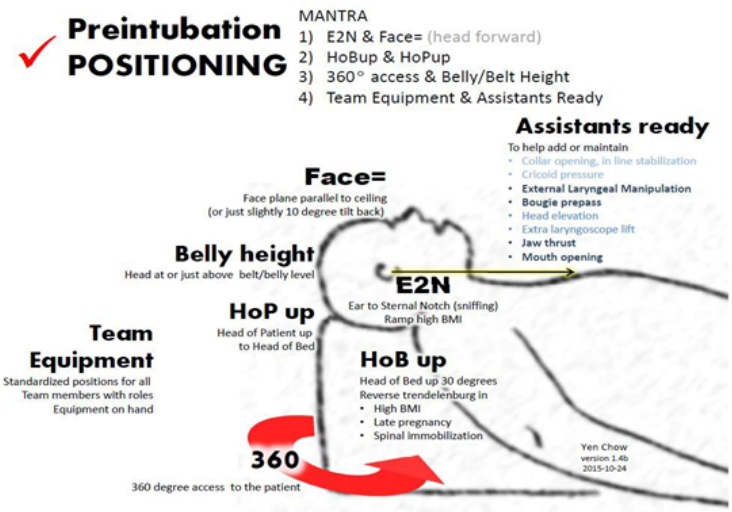
- Organizational goals of 85% first intubation attempt success for RSI and 95% overall success for RSI; 75% first intubation attempt success for all intubations and 90% overall success for all intubations

Organizational Approaches for Intubation

- Rapid Sequence Intubation (RSI): Critical Care Paramedic (CCP) with another certified intubator within a facility
- Sedation Facilitated Intubation: ACP(f) or CCP
- Crash Intubation ACP(f) or CCP
- Scene calls with out of hospital times of less than 30 minutes should defer intubation until arrival at the receiving emergency department unless absolute indications exist which include failure of oxygenation or ventilation, airway obstruction or impending airway obstruction not relieved by basic airway maneuvers
- Supraglottic airway should be the initial airway strategy in out of hospital cardiac arrest unless Endotracheal intubation is deemed more appropriate by the paramedic

Ornge Airway Manual-Executive Summary (continued)

Pre-intubation Patient Positioning



Patient Positioning

Proper patient positioning is an essential aspect of the preparation phase prior to intubation. Proper patient positioning will optimize the view obtained during laryngoscopy, and it will extend the time until hypoxia is encountered. It will also ensure required airway equipment is within reach and there is adequate physical space for the team should further interventions be required included BVM, SGA insertion, or cricothyrotomy.
Optimal patient positioning is determined by two major factors: the patient's physical location within their environment, and the patients specific positioning.
The premise of the ideal patient location allows team access 360 degrees around the patient with all required equipment within reach, where the patient is at optimal physical height on an adjustable stretcher and minimizing physical and environmental distractions.

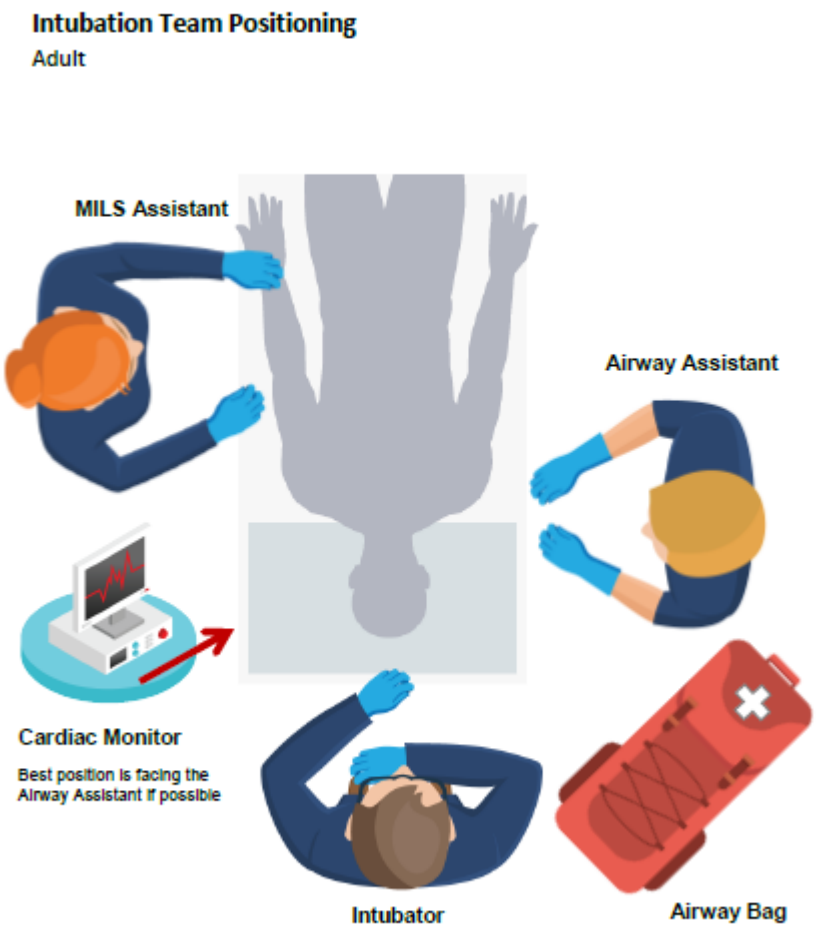
Hierarchy of Intubation Setting

Hospital bed in resuscitation room> Stretcher outside aircraft/ambulance > On the ground at scene call> In back of ambulance or aircraft while stationary or during transport

Patients' Physical Location

Access to the patient's airway, IVs, monitor and airway equipment is paramount when deciding the best setting for intubation. We advocate for 360-degree access around the patient under nearly all circumstances. The optimal location is nearly always a resuscitation room where there is adequate room for set up, however on some calls this will not be possible. For scene calls the back of an ambulance or the area outside the aircraft is optimal. Optimal patient positioning is outlined in the figure above. The patient's head should be at approximately the level of the umbilicus of the intubator, a horizontal line should intersect the patient's ear and sternal notch; frequently this will require manipulation of the patients head or shoulders using equipment nearby including a SAM splint or bed sheet. The intubator should be at the head of the stretcher and the patient's face should be horizontal.

Intubation Team positioning



The overarching philosophy is to standardize as many aspects as possible regarding the approach to the airway. Ensuring that 'cognitive noise' is reduced in stressful situations. That all Ornge paramedics will be familiar and comfortable with the process of intubation regardless of experience in the particular intubating setting or with their paramedic partner.

Team Geography Keys

- The airway bag may be placed on an adjacent hospital bed or tray table to the intubator's right, or on an adjacent stretcher or on the floor of the helicopter/road ambulance during scene calls
- The airway bag located between airway assistant and intubator for easy access
- Monitor positioned in direct view of the airway assistant
- 360 degree access to patient wherever possible
- If required, a Manual Inline Stabilization (MILS) assistant may be placed to the left of the intubator, providing cervical spine stabilization approaching from the patients left side or chest

Airway Bag

The standardized set up of airway equipment is within your standardized airway bag. This ensures that a complete set of equipment is readily available and prepared for a safe intubation or rescue airway management. Airway equipment is organized sequentially within the airway bag to correspond with airway interventions.

Ideally the airway bag should be placed on the intubator's right. This ensures that both team members will have timely access to any piece of airway equipment or back-up device. The strength of a standardized airway bag is familiarity, the location or setup of airway equipment should only be deviated from the norm in extenuating circumstances.

Airway Checklist

The Ornge intubation checklist should be used on all controlled intubations (RSI, SFI). This tool outlines the expected minimum standard preparation, equipment, and pre-briefing required for a safe intubation attempt and it helps provide the best possible chance at first pass intubation success. It also ensures that bystanders and other health care providers are aware of the airway plan, appropriate backups, and plan for failure. It is important to note that the airway checklist is meant to be a final check following set up for intubation - it should not be used as a recipe to organize equipment or discuss management. This should all be done in the 'prepare and plan' stage. It is analogous to a pilot's final checks before takeoff or landing-performed rapidly just prior to pushing drugs and starting time zero for intubation. The preparation has already been completed; the role of the checklist is to ensure that nothing has been missed. This requires the team to discuss the roles and expectations of each member; e.g. airway assistant maintain In-line Stabilization (MILS) assistant when required; prior to performing the checklist. The fail plan should include the initial approach to intubation as well as the expected next steps if a difficult airway is encountered. This should include a review of the 30 second drilled responses (below) for actions during the intubation attempt, actions required between intubation attempts, and the predicted approach to subsequent intubation attempts. Another important point is that the checklist should be done in a challenge-response fashion. Essentially this means that once the preparation for intubation is complete, the paramedic who opened and organized the airway bag will read aloud the checklist to their partner who is tasked with checking their partner's set up. Each point is meant to be a simple check, not a conversation (except for the team brief). In fact, the entire checklist should take no longer than 40-45 seconds with practice.

Controlled Intubation Checklist

Adapted from Greater Sydney Area-HEMS Checklist

Resuscitation	
Hemodynamics Optimized - Hypotension + Metabolic Acidosis Addressed	Check

Preparation	
Patient Positioned - Ear to Sternal Notch, Head Up, Occiput Elevated	Check
Cardiac Monitor - NIBP (q 2 minutes), SpO2, EtCO2	Check
O2 Supply Sufficient	Check
Preoxygenation - Mask O2 > 15LPM + Nasal O2 15 LPM/ NIPPV/ BVM + PEEP	Check
Ducanto Suction Prepared and Tested	Check
360 Degree Access if Possible	Check

IV/IO Medication	
2 IV/IOs Running Well	Check
BP Cuff on Opposite Arm	Check
Drugs/Doses - Induction, Paralysis, Post ETI Analgosedation	Check

Team Brief	
Airway Plan Briefed	Check
MILS Assistant Briefed - Neck Stabilized, Collar Open	Check
Airway Assistant Briefed - ELM/ Bougie	Check
Brief 30 Second Drills - Additional ELM / Extra Head Lift/ Operator Position/ Blade Change/ Blade Deep	Check

Equipment	
Assembled BVM Kit, (EtCO2, PEEP, Manometer)	Check
Standardized Airway Bag Open and Reviewed	Check
PPE including mask/face shield	Check
CMAC On + Working	Check
ETT	Check
Syringe + Cuff Tested	Check
Alternate ETT	Check
Bougie	Check
Hyperangulated CMAC + Stylet	Check
ETT/ SGA Securing Method	Check
SGA	Check
Cricothyrotomy Set	Check
Cricothyrotomy Assessment Completed	Check

"Checks Complete - Anaesthetizing at _____"

○ **Press CMAC Record Button**

Controlled Intubation Checklist (continued)

Post Intubation Checklist	
ETT/ SGA Placement Confirmed with ETCO2	Check
ETT/ SGA Secured, Depth Confirmed, Cuff Pressure 20-30 cm H2O	Check
Re-assess ABCs	Check
CMAC Record Button Off if Not Already Done	Check
Ventilator – Settings, Circuit, In-Line Suction, Filter, ETCO2	Check
Analgesia + Sedation	Check
HOB Raised to 30 Degrees	Check
NG + Foley PRN	Check
Secure all Lines and Tubes	Check
Rescue Airway Equipment within Reach	Check
Supplies – Oxygen, Drugs, Power, Airway Bag Packed Up	Check

Preoxygenation

A significant number of intubations fail due to, or are complicated by preventable hypoxia often due to insufficient pre-oxygenation. Adequate pre-oxygenation with 100% O2 maximizing SpO2 >95% (ideally as close to 100% as possible) and denitrogenation, prolongs safe apneic time before the patient becomes hypoxemic.

To maximize preoxygenation prior to intubation, a patient should be placed on a non-rebreather plus nasal cannula at flow rate tolerated by the conscious patient or have a bag valve masked placed over their airway for 3-5 mins with adequate mask seal to avoid entraining room air and enough oxygen flow to meet their minute ventilation; i.e. BVM reservoir does not fully collapse on inspiration. Adequate tidal volume is also necessary. If passive oxygenation does not result in adequate pre-oxygenation, positive pressure ventilation (PPV) with BVM should be initiated. This is best started at the decision to intubate ensuring preoxygenation occurs simultaneously with intubation preparation. Further, each patient requires high flow nasal cannula ensuring apneic oxygenation using 15 LPM via nasal prongs. This may not be tolerated by awake patients but should be titrated up as high as tolerated by the patient. Ensure adequate ventilation, RR and chest rise.

Difficulty and/or Hypoxia with intubation (SpO_2 <93% during attempt)

Any time there is encountered or anticipated difficulty intubating; one must change a part of the airway strategy in order to address the difficulty. This may occur during the attempt or with the next attempt. It is important to use the most familiar techniques and more familiar equipment during the first attempt by the most experienced intubator when there is anticipated difficulty, or when difficulty is encountered unexpectedly.

- Stop intubation attempt unless bougie or tube delivery into the trachea is visualized to be occurring (not blind tube or blind bougie delivery)
- Ventilate with optimized bag valve mask as necessary to re-oxygenate to over 93% (ideally over 95%).
  - 2 person BVM with ETCO2, two thumbs down face mask seal, pull face up into mask
  - Jaw thrust
  - BVM 15LPM + Nasal oxygen 15LPM
  - Oropharyngeal and two nasopharyngeal airways
  - Airways cleared
  - PEEP + Manometer
  - Position head neck upper body optimized
- Failure of optimized BVM to ventilate means a “Can’t-Intubate-Can’t-Oxygenate/Ventilate” scenario where rescue airway is emergently required.
  - Assess adequacy of ventilation clinically with good chest rise and fall and ETCO2 waveform
  - SpO_2 may be delayed to show reoxygenation despite good ventilation, particularly in those at risk for hypoxia or for those in shock states

- SpO_2 <90% and falling+ 2 person BVM + can't oxygenate/ventilate = Supraglottic Airway (SGA). Assistant can help with jaw thrust and mouth opening for insertion
- SpO_2 < 88% and falling+ SGA + can't oxygenate/ventilate = cricothyrotomy (> 40kg)
- Patch at first available opportunity to reassess options

If extreme difficulty is anticipated, it is also important to assess the risk and benefit of intubation. Is an alternative approach better given the current team, scope of practice, equipment, drugs, resources and surrounding environment?

Drilled Responses to the Difficult Airway

(Blade is in the mouth but you are having difficulty generating a view of the glottis)

If, during intubation, there is difficulty successfully placing the endotracheal tube or if the intubation attempt is aborted due to hypoxia, it is vital the team flawlessly transition to the next phase of the airway management plan as verbalized during the airway checklist briefing. However, it is also vitally important the team take a number of steps to transition from plan A to plan B and to plan C.

A number of HEMS organizations have incorporated the concept of '30-second drills' when dealing with airway difficulty. The idea is that after initial stabilization and re-oxygenation (see below), there must be a rapid, coordinated change before a subsequent re-attempt at intubation. This may include changing the operator in charge of intubation, changing an aspect of the patient positioning to improve success, or changing a piece of equipment. After a third unsuccessful attempt, it is very unlikely to achieve success with further airway attempts. At this point a rescue airway should be initiated according to the airway algorithm.

30 Second Drilled Responses to Optimize Attempt at Laryngoscopy (these can be utilized during intubation attempts when encountering difficulty or between intubation attempts):

Initial Responses (intubator's two hands AND assistant do FIVE things)

- **Extra Laryngeal Manipulation (ELM) - Assistant to maintain with guidance from intubator**
- **Extra head elevation**
- **Extra laryngoscope lift (two hands)**
- **Use Mac blade with Miller technique (use a Mac 4)**
- **Use bougie if not already in use**

Standardized Approach and special considerations

- Standard Geometry Video Laryngoscopy with bougie should be utilized as the first attempt for all intubations.
  - As the number of attempts increases, complications and failure rates significantly increase.
  - The rationale of using a standardized approach for the occasional intubator is to maximize competence using the technique.
  - Using VL on first attempts requires an incremental approach, leading with appropriate high volume suction to manage fluids which may negatively impact the intubators view. If fluids continue to be present, "parking" the suction wand in the left side of the hypopharynx in the proximal esophagus may facilitate improved laryngoscopy.
- Change blade size or type or technique:
  - Progressive landmark identification following the back of the tongue to epiglottis, sweeping tongue to the left simultaneously followed by laryngeal exposure
    - The intubator should verbalize their progress to facilitate maintenance of team situational awareness
  - Preferred start in adults with Mac4 blade
  - If epiglottis control is not adequate then use Mac blade with Miller technique to pick up epiglottis tip
  - Consider plunge and withdraw (insert laryngoscope deeply and slowly withdraw until identifiable anatomy is seen)
  - Consider straight blade right paraglossal technique if trained/practiced

- Miller blade is inserted at the far right corner of the mouth and passed along the groove between the tongue and tonsil using leftward and anterior pressure to displace the tongue to the left of the laryngoscope and to maintain tongue in this position at all time

- Following failure of laryngoscopy attempt # 1, re-optimizing the attempt, or the addition of Hyperangulated VL with stylet or bougie should be undertaken.
- Additional attempts should be optimized and undertaken with support of the most experienced intubator.
- BVM with adjuncts including OPA/NPA or SGA should be undertaken at any point when Sp02 is newly < 93%.
- Address tone/muscle relaxation if possible
- Use straight to cuff shaping for styletted endotracheal tube
- Deliver the bougie or styletted tube from the extreme right corner of the mouth and have assistant pull right cheek for extra space
- On railroading ETT over bougie, keep laryngoscope in position left turn ETT as the tube tip reaches to the Laryngeal inlet
- Blind bougie as a last resort if only the epiglottis is seen despite best attempts at laryngeal exposure-feel for tracheal clicks/distal hold up (usually between 24-40 cm)

Video-Laryngoscopy

Video Laryngoscopy (VL) should be used for ALL intubations and ALL intubation attempts should be recorded using the VL device. VL with a standard geometry (SG) blade should be used for the first attempt. SG blades can be utilized for direct laryngoscopy if required. If the first attempt fails consider all of the options listed above to optimize your view and consider switching to a hyper-angulated (HA) blade.

Supraglottic Airway

Indications:

- Weight >2 kg
- Need for ventilatory assistance OR airway control AND
- Other airway management is inadequate OR ineffective OR unsuccessful

Contraindications:

- Intact gag reflex
- Caustic ingestion
- Active vomiting

Treatment:

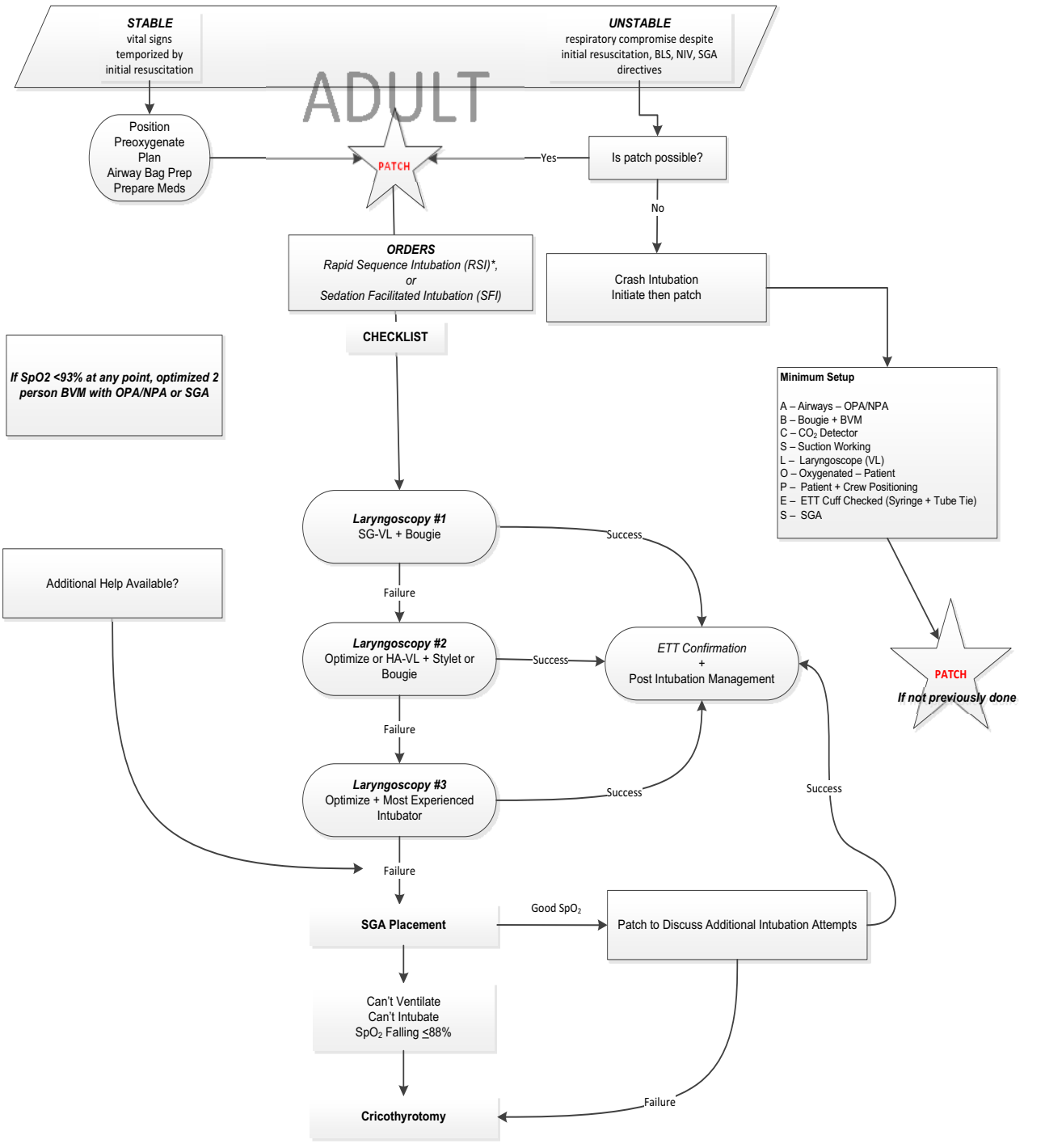
		Supraglottic Airway
≥ PCP(f)	Initiate then Patch	Insert Airway MAX 2 attempts If two (2) attempts at supraglottic airway have failed, then revert to BVM and oral / nasal pharyngeal airway management

Clinical Considerations/Notes:

- Supraglottic airway should be the initial airway strategy in out of hospital cardiac arrest unless endotracheal intubation is deemed more appropriate by the paramedic
- Endotracheal intubation is usually preferred for secure airway management in the non cardiac arrest patient. In this setting, SGA is considered a rescue device if BLS airway/ventilation and other advanced airway maneuvers have been unsuccessful
- Confirm placement (EtCO2 waveform + chest rise)

Universal Airway Algorithm

Universal Airway Algorithm



30 Second Drills

For Optimized laryngoscopy
Initial Responses (Intubators 2 hands AND Assistant)

- Extra Laryngeal Manipulation (ELM) → Assistant to maintain with guidance from intubator
- Extra head elevation
- Extra Laryngoscope lift (two hands)
- Use Mac blade with Miller technique (use Mac 4)
- Use bougie if not already in use

Legend

*RSI – In Facility Only
SG-VL = Standard Geometry Video Laryngoscopy
HA-VL = Hyperangulated or D Blade Video Laryngoscopy

Adapted from STC Failed Airway Algorithm – EMCrit RemixV2.0

Universal Airway Algorithm (continued)

Scene intubations for out of hospital times less than 30 minutes should only be done where BLS interventions are unable to obtain or maintain the airway or unable to correct life threatening oxygenation and ventilation compromise.

"ABC SLOPES" for the minimal mission critical items for any intubation: Airways – OPA/ NPA; Bougie + BVM; CO2 detector; Suction working; Laryngoscope (VL); Oxygenated - Patient; Patient + crew positioning; ETT cuff checked (Syringe + Tube Tie); SGA

If SpO2 cannot be optimized to >93%, a quick 30 second attempt at rapid intubation can be tried before proceeding down failure to oxygenate.

An intubation "attempt" is defined as inserting the laryngoscope blade into the mouth for the purpose of viewing the epiglottis or laryngeal exposure for tube delivery.

Standard Geometry VL with bougie is the expected first approach to intubation. The intent is to maximize proficiency with these techniques for occasional intubators. Occasionally, hyper-angulated VL may be considered for first attempt if required by patient anatomy.

RSI

RSI is the preferred and recommended method of intubation whenever possible, while in facility. RSI should not be done in the field.

Predicted difficulty for intubation is not an absolute contraindication to RSI especially if the planned backup of ventilation by face mask or supraglottic airway has no anticipated difficulties. RSI in general will optimize the best chances for intubation success.

RSI involves the use of neuromuscular blocking agents to achieve rapid paralysis, usually along with an induction agent for rapid onset of anesthesia. Agents are chosen to avoid contraindications to the specific drugs as well as avoid complications and risks to the individual patient (hypotension, desaturation etc). The preferred induction and paralytic agents for most RSI are Ketamine and Rocuronium.

The minimum personnel required is one CCP and one other trained intubator (sending facility privileges or Ornge certified) and is for "in-facility" situations only. Mandatory patch with orders are required prior to RSI.

Give induction agent by IV push immediately followed by paralytic agent by rapid IV push.

Refer to medical directives for the specific dosing and administration.

Topicalize airway

Lidocaine spray should be used in the upper airway and the perilaryngeal structures whenever possible in order to reduce the response to laryngoscopy and intubation. This is particularly helpful in non-RSI airways especially if less reliable agents for sedation are being used like midazolam and fentanyl.

SFI

Sedation facilitated intubation will usually require an element of patient cooperation. These agents (fentanyl, midazolam, and ketamine) have a slower onset of action compared to the anesthetic induction agent and are less reliable as well as variable in effect from patient to patient.

This method is to be avoided if possible as not enough sedation may result in poor intubating conditions, however too much sedation (fentanyl, midazolam) will result in hypoventilation and airway tone loss and obstruction however still not produce optimal intubating conditions. Conversely, benzodiazepines may work best in sympathomimetic toxidromes.

Ketamine may not produce enough muscle relaxation to have optimal intubating conditions as a single agent. Ketamine will have minimal effect on airway tone and respiratory drive.

Mandatory patch with orders are required prior to SFI.

Refer to medical directives for specific dosing. Ketamine induction doses are given slowly over 30 seconds (high doses given rapidly can cause transient apnea). Small doses (<20mg) for titrated dissociation can be given rapidly.

Refer to medical directives for specific dosing.

Pre-Intubation and Intubation Medications

Indications:

- Intubation attempts

Contraindications:

- Allergy or sensitivity to the medication
- See specific contraindications for medications below

Treatment:

It is expected that in virtually ALL circumstances the Paramedic will patch to the TMP prior to performing a Rapid Sequence Intubation or Sedation Facilitated Intubation (SFI) (see mandatory patch points below) but it is recognized that there may be rare circumstances in which a patient requires immediate intubation with sedation/ dissociation and a timely patch cannot be completed. In this circumstance utilize the medication guidelines below to perform the intubation and patch as soon as possible.

≥ ACP(L) / Initiate then Patch	**Lidocaine (Xylocaine) Spray***
	10 mg/spray onto the pharynx, hypopharynx MAX cumulative dose of 5 mg/kg or 400 mg

*Consider Lidocaine for oro-tracheal facilitated and awake intubations

For Sedation

Choose only one sedative agent +/- analgesic
KETAMINE IS THE PREFERRED AGENT IN THE MAJORITY OF PATIENTS

≥ ACP(f) / Mandatory Patch	**Ketamine**	
	Induction dose	**Reduced titration dose**
	0.5mg-2 mg/kg IV over 30 seconds Use 0.5 mg/kg in patient exhibiting signs of shock	Push escalating doses 10-30 mg IV q 60 seconds Goal 2 mg/kg within 5 minutes Crashing pre-arrest patient Poor cardiovascular reserve Potential difficult airway for awake intubation

OR

≥ ACP(f) / Mandatory Patch	**Midazolam (Versed)**
	0.1 mg/kg IV (to a MAX of 8 mg) *contraindicated* if MAP < 80 **Titrating doses (up to the above doses) in potentially difficult airway for awake intubation (1-2 mg every 3-5 minutes)**

OR

≥ CCP / Mandatory Patch	**Etomidate (Amidate)**
	0.2-0.3 mg/kg IV/IO

Pre-Intubation and Intubation Medications (continued)

OR

≥ CCP(f) / Mandatory Patch	**Propofol (Diprivan)**
	MAP > 100 1.0-1.5 mg/kg IV/IO

CAUTION:

- Respiratory apnea and hypotension may occur with rapid induction
- Avoid in elderly or hypovolemia or poor cardiovascular reserve
- Phenylephrine should be used to support BP if hypotension occurs
- Should be avoided in hypotension with head injury

For Analgesia

≥ ACP(f) / Mandatory Patch	**fentaNYL (Sublimaze)**
	MAP > 80 1-2 microgram/kg IV/IO

Avoid or reduced titrated dosage (25-50 microgram IV every 3-5 minutes) if elderly, decreased level of consciousness, or maximally sympathetically stimulated and poor cardiovascular reserve

For Paralysis

ROCURONIUM IS THE PREFERRED PARALYTIC IN THE MAJORITY OF PATIENTS

CCP / Mandatory Patch	**Rocuronium (Zemuron)**
	1.2 mg/kg IV/IO

≥ CCP / Mandatory Patch	**Succinylcholine (Anectine)**
	1.5 mg/kg IV/IO

Contraindicated With:

- Malignant hyperthermia
- Hyperkalemia (known or concern)
- Myopathies/Muscular dystrophies
- Amyotrophic Lateral Sclerosis, Multiple Sclerosis
- Guillain-Barre Syndrome, botulism
- Burns ≥ 2nd degree over 10% BSA > 24 hours until healed
- Stroke with hemiparesis, spinal cord injury > 72 hours until 6 months post injury
- Severe intra-abdominal sepsis > 72 hours until resolution

Pre-Intubation and Intubation Medications (continued)

Treatment of Hypotension associated with Sedation

		Phenylephrine (Neosynephrine)
CCP	No Patch Required	**MAP < 65** MAP < 80 (high ICP, ischemic stroke or spinal cord injury) 100 micrograms IV/IO q 3 minutes prn MAX 3 doses (300 micrograms)

Clinical Considerations/Notes:

- RSI intubation falls under the CCP and PCCP/PCCN scope
- If patient requires recurrent doses of phenylephrine to maintain adequate MAP consult the TMP

Emergency Tracheostomy Tube Reinsertion

Indications:

- Patient with existing tracheostomy where the inner and/or outer cannula(s) have been removed from the airway;
  AND
- Respiratory distress
  AND
- Inability to adequately ventilate

Contraindications:

- Inability to landmark or visualize

Treatment:

≥ PCP(f)	Initiate Then Patch	**Consider Emergency Tracheostomy Tube Reinsertion** The Maximum number of attempts is 2 If unable to replace, initiate BVM from above Requires occlusion of the stoma with palm of hand, tegaderm or occlusive dressing
≥ ACP(L)	Initiate Then Patch	If cannot re-insert existing tracheostomy tube or re-insert an alternate tracheostomy tube Place cuffed ETT 6.0 or smaller over bougie through patient stoma site Confirm with ETC02 and clinical indicators

Clinical Considerations/Notes

- Risk is much higher on reinsertion of tube into tracheostomy, cricothyrotomy, or laryngectomy site when less than 7 days since creation. Reinsertion may create a false passage with subcutaneous emphysema and fatal hypoxia due to inability to secure the airway
- Risk is higher if tube placed for airway obstruction, difficult airway, or laryngectomy (due to inability to manage airway from above)
- At minimum always bring a spare inner cannula which is size and type (disposable or reusable) specific for patient's tracheostomy tube
- At minimum, a complete spare tracheostomy tube one size smaller should be available during transport
- Ensure tracheostomy ties are snug (i.e. can only fit two fingers between the tie and the patient's neck) prior to transport
- A reinsertion attempt is defined as the insertion of the cannula into the tracheostomy replacing the inner and/or outer cannula with a new one is preferred over cleaning and reusing an existing one
  NOTE: *Please refer to the matrix below on the next page.*

Emergency Tracheostomy Tube Reinsertion (continued)

	Tube in place < 7 days	Tube in place >7 days
No history or airway obstruction or difficult airway	Lower risk. Attempt BVM/Bipap/intubation from above first; if fails consider reinsertion with trach tube	Lower risk. Attempt reinsertion with trach tube first, then bougie with ETT If fails, manage from above.
History airway obstruction or difficult airway or laryngectomy tube	High risk MANDATORY discussion between TMP and Sending MD. Trach tube must be sutured in place by sending. Explicit discussion between TMP and sending MD required regarding risk/benefit of transport in conjunction with the urgency of transport. Utilization of a sending escort who can manage surgical airway issues or deferral of transport until track maturity should be considered	Medium Risk Confirm that at least one trach tube change post initiation has taken place without difficulty. Attempt reinsertion with trach tube first, then bougie with ETT. If fails, manage from above (unless laryngectomy tube).

Respiratory

Consider and Document Risk Factors for Severe Asthma to risk stratify patients experiencing asthma exacerbations. Features include:

- Increased usage of puffers
- Steroids
- Prior intubations
- Previous ICU admissions
- Tiring
- Silent chest
- Poor pulmonary function test results or concerning blood gas results (increased or normal $PC0_2$)[1]

Oxygenation should be monitored and supplemental oxygen should be used to support adequate oxygenation in hypoxic asthma patients.[2] All patients should receive aggressive B2 agonists, MDI when possible and nebulized when the patient is unable.[3] IV B2 agonists may be considered for refractory severe asthma.[4] All patients should receive anticholinergics by MDI (metered dose inhaler) or nebulized for severe asthma.[5] Mg sulphate should be considered and routinely used for severe asthma.[6] Inhaled steroids should be used for severe asthma.[7] Systemic steroids should be used PO or IV for all cases of severe asthma.[8] For refractory severe asthma, EPINEPHrine IM or IV can be used.[4] Non Invasive PPV should be used when tolerated by the patient with the aim to avoid intubation.[9] Intubation should be used when severe asthma is refractory to other interventions.[10] The decision to intubate should be based mainly on clinical judgement. Clinical judgment is crucial because many patients presenting with hypercapnia do not require intubation and thus the decision should not be based solely on blood gases.[11]

Markers of deterioration include:

- Rising carbon dioxide levels (including normalization in a previously hypocapnic patient)
- Exhaustion
- Mental status depression
- Hemodynamic instability and refractory hypoxaemia

Ventilation strategies should include:

- Prolongation of the I:E ratio (extending E time and shortening I time)
- Using adequate analgesia, sedation and paralysis. Ketamine is the preferred agent.
- Tidal volumes of 5-6 ml/kg Ideal Body Weight
- RR 8-12 breaths/min
- PEEP 5 cm H2O
- pH above 7.25
- Pplat <30 if possible.[12] (see Ventilation medical directive)
- Ventilation strategies should focus on minimizing gas-trapping.[13]

Dynamic hyperinflation with increased intrathoracic pressure and hypotension may occur particularly with intubated asthmatic patients that are over-ventilated. Compress the chest and allow for exhalation of Auto-PEEP in the case of hypotension, shock and PEA in the setting of an intubated/apneic asthmatic. Pneumothoraces should also be considered.

Bronchoconstriction

Indications:

- Respiratory distress AND
- Suspected bronchoconstriction

Contraindications:

- Allergy or sensitivity to the medication
- Allergy to peanuts (i.e. Ipratropium Bromide (Atrovent)

Treatment:

Bronchoconstriction - All patients

≥ PCP(f) / No Patch Required
Salbutamol (Ventolin) MDI (100 microgram/puff)
8 puffs (45 seconds between each administration) may repeat x 3 q 5-15 minutes prn

≥ PCP(f) / No Patch Required
Salbutamol (Ventolin) Solution Via Nebulized Aerosol (2.5 mg/2.5 mL)
5 mg q 5-15 minutes x 3 prn

*Total volume of Salbutamol and Normal Saline should be 3 mL

≥ ACP(f) / No Patch Required
Ipratropium Bromide (Atrovent) MDI (20 microgram/puff)
5 puffs (45 seconds between each administration) may repeat x 3 every 15 minutes prn MAX 3 doses

≥ ACP(f) / No Patch Required
Ipratropium Bromide (Atrovent) Solution Via Nebulized Aerosol (250 microgram/mL)
500 micrograms q 15 minutes x 3 prn MAX 3 doses

*Total volume of Ipratropium Bromide (Atrovent) and Normal Saline should be 3 mL

Bronchoconstriction (continued)

Severe Bronchochonstriction/Asthma Exacerbation

≥ PCP(f) / Initiate then Patch	**EPINEPHrine (Adrenalin)**
	0.01 mg/kg IM (1:1000) MAX 0.5 mg IM

Use with caution when history of coronary artery disease or stroke

≥ ACP(f) / Mandatory Patch	**Steroids**
	methylPREDNISolone 125 mg IV/IO OR Dexamethasone 8 mg IM/IV/IO

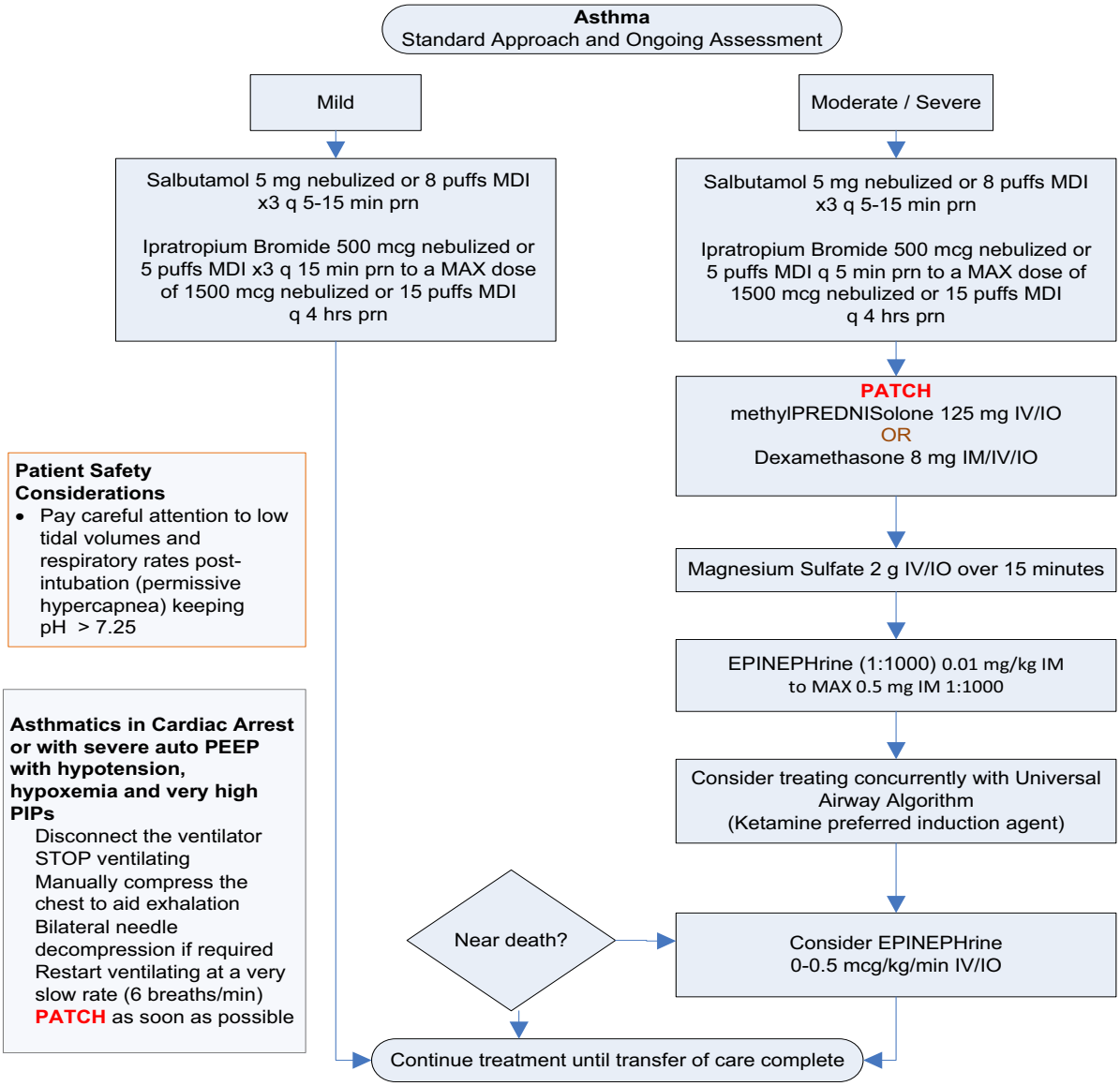
≥ ACP(f) / Mandatory Patch	**Magnesium Sulfate**
	2 g (4 mL)/ 100 mL Administer over 15 minutes

≥ CCP / Mandatory Patch	**EPINEPHrine (Adrenalin)**
	0-0.5 microgram/kg/min IV/IO

Clinical Considerations/Notes:

- MDI delivery systems require 45 seconds to “re-charge” between doses. Not waiting the recommended length of time between doses will result in significantly decreased amounts of medication being delivered/ activation
- In the event of a respiratory outbreak as identified by originating facility / Ornge, the MDI must be used instead of nebulization
- Side effects of Magnesium Sulfate include hypotension; monitor BP closely

Bronchoconstriction (continued)



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https://www.ahsems.com/public/protocols/templates/desktop/#home

Tension Pneumothorax

Indications:

- Severe respiratory distress in the setting of chest trauma with hemodynamic compromise
  AND/OR
- Traumatic VSAs
  AND/OR
- Severe hemodynamic compromise during positive pressure ventilation particularly in trauma or asthma or COPD patients
  AND/OR
- Chest trauma, Severe Asthma or COPD, hemodynamic compromise **and** one or more of the following:
  - Decreased/absent breath sounds on affected side
  - Cyanosis
  - JVD
  - Hyper resonance on affected side
  - Tracheal shift (late sign)

Contraindications:

- Not applicable

Treatment:

≥ ACP(L)	Initiate then Patch	**Consider differential diagnosis and decompress if high probability of tension pneumothorax**

Clinical Considerations/Notes:

- The patient must be seen as soon as possible at an appropriate facility for the insertion of chest tube(s)
- Consider differential diagnosis:
  - Main stem intubation
  - Pleural effusion
  - Hemothorax
  - Consolidated pneumonia
  - Auto PEEP
  - Dynamic hyperinflation

Maintenance of Chest Tubes

Indications:

- Initiated by sending facility

Contraindications:

- Not applicable

Treatment:

≥ ACP(f)	No Patch Required	**Maintain chest drainage systems during call to keep the drainage system clear**	
		If the patient's chest tube was maintained by suction at the sending facility, the Paramedic may maintain suction to no greater than -20 cm H_2O	If the patient's chest tube was maintained by gravity drainage, the Paramedic may maintain by gravity drainage to underwater seal or to suction as per patient presentation

Clinical Considerations/Notes:

- A Heimlich flutter valve may be adequate if no drainage system has been implemented
- Suction beyond -20 cm H_2O requires patch authorization prior to transport

Ornge Clinical Practice Guideline: Mechanical Ventilation

Please refer to the *Drug Monographs and References* document for references listed in the CPGs

1. Mechanical ventilation is usually indicated in the following scenarios:
    a. Hypoxemic respiratory failure
    b. Hypercapneic respiratory failure
    c. Mixed hypoxemic/hypercapneic respiratory failure
    d. Transport of patient intubated for other reasons; i.e. (airway protection for primary neurological issues, excessive secretions, shock)
2. Mechanical ventilation may be harmful to patients, especially those with acute lung injury (ALI)/acute respiratory distress syndrome (ARDS), through one or more of the following mechanisms:
    a. Volutrauma (excessive tidal volumes- ideal target 6 mL/kg ideal body weight to avoid alveolar over distension)
    b. Barotrauma (excessive plateau airway pressures- ideal target < 30 cm H_20)
    c. Atelectrauma (recurrent opening and closing of alveoli- ideal target of maintaining an "open" lung using PEEP)
    d. Biotrauma (release of local and systemic inflammatory cytokines/mediators from lungs due to volutrauma, barotrauma and atelectrauma)
3. Appropriate endotracheal tube placement must be confirmed prior to departing the sending facility:
    a. If available, a Chest X-ray (CXR) should be reviewed by the Ornge team at the sending facility to confirm appropriate endotracheal tube depth of insertion. Alternatively confirmation of appropriate ETT position can be obtained through discussion with the sending physician or review of a final report from a radiologist
    b. Should the clinical situation warrant in the judgment of the Ornge crew and the TMP on duty, clinical confirmation of ETT position without radiological confirmation may be sufficient when delays in transport to definitive care place the patient at greater risk than the potential risk of transporting without review of the CXR
    c. Continuous ETCO2 monitoring should be performed to assist in detection of inadvertent ETT dislodgement during transport
    d. ETT must be properly secured during packaging for transport. In cases of anticipated potential difficulty in reintubation after potential ETT dislodgement, ongoing neuromuscular blockade in addition to heavy sedation should be considered
4. ETT cuff inflation pressures should be checked and documented for all intubated patients to avoid excessive cuff pressures, which can lead to tracheal ischemia and injury
5. Clamping of the ETT prior to any intentional disconnection from the ventilator; i.e. when transferring the patient from a hospital ventilator at the sending facility to the transport ventilator should be performed to avoid lung de-recruitment, ensuring analgosedation +/- paralysis is maximized to prevent negative consequences such as pulmonary edema caused by maximal inspiration attempts against a clamped ETT.
    NOTE: Do not clamp an armour ETT as this may result in a kink in the metal reinforcement of these ETTs.
6. An appropriate mode of ventilation should be selected based on the patient condition
    a. Patients with spontaneous respiratory effort not requiring high levels of mechanical ventilation support should be ventilated using pressure support ventilation, which has been shown to decrease sedation requirements and provide better patient comfort. PSV levels should not be set < 8 cm H_2O
    b. Patients requiring higher levels of mechanical ventilation support due to severe respiratory failure, patients without adequate drive to breathe and patients who require control of ETCO2 for non-respiratory reasons should be ventilated using a controlled mode of ventilation (AC with pressure control, or volume control)
    c. Ornge crew should be prepared to switch from pressure support to a controlled mode of ventilation in the event of over sedation or other change in clinical condition
7. Goal-directed ventilation should be provided by the Ornge crew using medical directives or direct medical control through patch as follows:
    a. Initial inspired oxygen concentration should be determined by matching sending hospital settings or starting at 100% oxygen and titrating down based on oxygen saturation readings

b. Oxygen saturation should be maintained routinely with a target of 94-98% unless an alternate target is indicated
   i Hyperoxia can be harmful in settings of acute neurological injury (stroke, post-cardiac arrest) and myocardial infarction. SpO2 should be targeted between 94-98%
   ii High FiO_2 (>0.8) may be associated with increased risk of lung injury due to worsening of lung inflammation
   iii High FiO_2 (>0.8) may cause washout of nitrogen and subsequent alveolar micro-atelectasis
   iv Oxygen saturation levels of 100% may be associated with extremely high PaO_2 levels and should be avoided
   v FiO_2 should be titrated down as much as possible to avoid hyperoxia
   vi Patients with known or suspected CO_2 retention as determined by history and/or baseline high serum bicarbonate levels should have a lower O_2 saturation target (88-92%)
   vii In patients with severe hypoxic respiratory failure, lower O_2 saturation target may be tolerated (> 88% target, “permissive hypoxemia")
   viii Permissive hypoxemia should be avoided in pregnant patients and patients with carbon monoxide poisoning, and in such cases higher than usual FiO_2 may be maintained
   ix Consider reducing cabin altitude in patients with refractory hypoxemia as tolerated by operational constraints
c. Adequate PEEP should be applied to maintain an open lung strategy, thereby avoiding atelectasis and potential lung injury, and also allowing reduction in FiO_2
   i All intubated patients should receive PEEP of at least 5 to compensate for loss of physiological PEEP due to endotracheal intubation
   ii In patients with ARDS and FiO_2 > 0.6 should receive PEEP higher than 5 to support improved lung recruitment and allow eventual weaning of the FiO_2
   iii Patients with ARDS; as FiO_2 is increased, PEEP should also be increased to improve lung recruitment using the ARDSnet table as a guide
   iv DeltaP (Pplat minus PEEP) should be less than 15 cm H_2O as higher values are associated with adverse outcomes/mortality
d. I:E ratios are typically set at 1:2-1:3 for patients with minimal lung pathology
   i Consider adjusting the I:E ratio by increasing inspiratory time as another strategy to increase mean airway pressure and therefore oxygenation (typically 1:1.5 or in extreme situations 1:1)
   ii Inverse ratio ventilation (I time > E time) presents significant challenges in terms of ventilation and hemodynamics, and should only be done after careful discussion with the TMP
   iii Patients with severe expiratory air flow limitation; (i.e. asthma, COPD) may require much longer E time
   iv Patients with hypercapnea associated with severe obstructive airway disease may require non-intuitive strategies to lower $PaCO_2$ such as reducing the respiratory rate and decreasing the I time
e. Patients with ARDS and high FiO_2 requirements and/or difficulty achieving oxygenation targets should prompt consideration of a recruitment maneuver
   i 40 cm H_20 pressure delivered for 40 seconds as tolerated by hemodynamics and oxygenation
   ii Recruitment maneuvers should be ideally performed at the sending facility prior to placement on the transport ventilator, ensuring ETT clamping during switch between ventilators to avoid alveolar de-recruitment (refer to recruitment maneuver in Medical Directive)
   iii Analgosedation +/- paralysis should be optimized prior to performing recruit maneuvers or ETT clamping.
f. Target tidal volume should be determined using a 6-8 mL/kg target, with calculated ideal body weight based on height and gender-based formula for all mechanically ventilated patients. Note, if PIP or plateau pressures >30 cm H_2O then adjust Vt target to 4-6 ml/kg IBW
g. ETCO2 target should be determined for all mechanically ventilated patients based on clinical condition and acid-base status

i Default ETCO2 target is 35-45 mm Hg
ii Patients with increased ICP but no signs of herniation should have a target of an ETC02 33-38
iii Patients requiring immediate temporary relief of life-threatening high intracranial pressure or herniation should have a target of an ETCO2 30-35 mm Hg (short-term mild hyperventilation)
iv Patients who have pre-existing acid-base disturbances should have an adjusted ETCO2 target to account for differences in baseline bicarbonate levels
- When available patients should have a documented bicarbonate level from recent ABG, VBG or electrolytes in the call report
- Extreme bicarbonate levels should prompt an adjusted ETCO2 target to avoid causing extreme arterial pH through excessive hyper/hypoventilation
  - o HCO_3 > 35 should warrant a higher ETCO2 target
  - o HCO_3 < 15 should warrant a lower ETCO2 target

h. Ornge crews should determine the appropriate amount of Pressure Support or Pressure Control to achieve the target Vt, or monitor airway pressures if using a volume controlled mode of ventilation
i Plateau pressures of > 30 cm H_20 should be avoided whenever possible to reduce risk of barotrauma (ventilator induced lung injury, pneumothorax, pneumomediastinum)
ii For patients with poor respiratory system compliance which prevents achieving target Vt without exceeding plateau pressures of > 30 cm H2O
iii O_2, the TMP should order a strategy of permissive hypercapnea with target pH > 7.2-7.25 and adjusted higher ETCO2 target depending on baseline serum bicarbonate ;(i.e., ETCO2 50-60); achieved with tidal volumes 4-6 ml/kg IBW. NOTE: tidal volume should never be set < 4 ml/kg IBW, as a result, PIP/Plateau > 30 cm H2O may be tolerated; e.g. severe air flow obstruction (asthma)
iv Judicious use of sedation and neuromuscular blockade should be considered to improve respiratory system compliance for those difficult to safely ventilate
v The TMP should discuss with the sending facility alternate strategies to improve respiratory system compliance prior to transport ;i.e. drainage of pleural effusion, decompression of abdominal distension with nasogastric tube placement, diuresis
vi Consider other reversible factors contributing to higher driving pressure requirements and provide appropriate treatment
- Bronchodilators for higher airway resistance in patients with asthma/COPD
- Main stem bronchus intubation
- Kinked ETT or patient chewing on the ETT
- Suctioning of the ETT in case of excessive secretions
- Decompression of a new pneumothorax
- Diuresis in the setting of pulmonary edema

8. Patients requiring mechanical ventilation should be provided measures to ensure their comfort and encourage ventilator/patient synchrony
   a. All intubated patients should receive analgesia to control their pain with infusion and/or bolus narcotic agents
   b. Ventilator/patient asynchrony may originate in the ventilator sensitivity setting; i.e. auto-cycling during a turbulent transport; adjust the sensitivity to trigger only on patient initiated efforts
   c. Adequate sedation should be achieved using agents such as propofol (CCP & PCCP/PCCN ONLY) Ketamine or midazolam as required based on the patient's vital signs and presenting condition
   d. Ventilator synchrony may be better achieved using a combination of analgesia and sedation agents rather than single agents alone
   e. Consider ketamine as first line therapy in patients with borderline hemodynamics
   f. Non-medication measures to improve patient comfort should be used when possible i.e. noise reduction devices; to minimize need for comfort medications
   g. Patients who are difficult to ventilate/oxygenate may require deep sedation and/or neuromuscular blockade to allow optimal flexibility in providing mechanical ventilation support

Initiating or Maintaining Mechanical Ventilation

Indications:

- Need for mechanical ventilation
- Hypoxemic respiratory failure
- Hypercapnic respiratory failure
- Mixed hypoxemic hypercapnic respiratory failure
- ETI airway management for transport

Contraindications:

- Not applicable

Treatment:

All mechanically ventilated patients should be managed using standard settings with "goal-directed ventilation orders"

- CCPs may initiate and maintain mechanical ventilation without patching for patients who are intubated/ ventilated for airway protection/patency; or patients with mild-to-moderate respiratory failure that do not require high levels of mechanical ventilation support
- CCPs are not required to patch if they can achieve the following:
  - Ventilation goals:
    - SpO_2 94-98% (88-92% if known CO_2 retainer and this is target SpO_2 at sending facility)
    - ETCO2 35-45 (or 33-38 if increased ICP)
  - Using mechanical ventilation settings within the following safety parameters:
    - Vt 6-8 ml/kg IBW (target Vt must be calculated and documented in ePCR)
    - Frequency of 10-20 breaths per minute
    - FiO_2 0.6 or less
    - PEEP range 5-10
    - Peak and plateau pressure less than or equal to 30 cm H_20
    - I:E ratio range 1:1.5-3.0
- Contraindications to CCP initiation and maintenance of mechanical ventilation without patch include:
  - Sending facility ventilation settings outside of safety parameters above
    - Exception: If FiO_2 at sending facility higher than 0.6, CCP medics may attempt brief weaning trial prior to departing sending facility and if able to wean to 0.6 and achieve oxygen saturation 94-98% patch not required
  - Inability to maintain mechanical ventilation goals without exceeding safety parameters above
  - Use of oxygenation adjuncts at sending facility such as inhaled heliox, nitric oxide, inhaled Flolan or prone positioning
  - Serum bicarbonate (from ABG/VBG/electrolytes) < 15 or > 35 (need to clarify pH/ETCO2 target with TMP)
- CCPs may use AC Pressure Control ventilation or Volume Control ventilation to achieve mechanical ventilation goals for patients requiring controlled ventilation with guaranteed rate/minute ventilation; for patients spontaneously breathing consider Pressure Support ventilation* (potential benefit of decreased need for sedation)
- ACP(f)s **MUST** patch prior to initiating or maintaining ventilation in ALL patients.
- All paramedics should plan to ventilate patients utilizing the treatment guidelines below.
- When mechanical ventilation is initiated, all settings and patient's response to treatment must be documented on the Call Report. The patient's end tidal CO_2, O_2 saturation levels, RR_{total}, Vt, FiO2, PEEP and PIPs must be continuously monitored and recorded

**Pressure Support Ventilation (PSV) on the LTV 1200 is achieved by setting the ventilator to Pressure + SIMV/CPAP + Breath Rate to zero (--).*

Initiating or Maintaining Mechanical Ventilation (continued)

Assessment and Preparation of the Ventilated Patient

≥ ACP(f)	No Patch Required	Confirm ETT placement (ETCO2 & Auscultation) and ETT depth at least 21 cm at the lips in females and 23 cm at the lips in males. Check ETT cuff pressure 20-30 cm H2O. Obtain baseline vital signs. Choose mode of ventilation for patient: • PSV if awake & spontaneously breathing; • AC with either PCV or VC if inadequate respirations, heavily sedated or high ventilator settings required. Perform leak test on ventilator circuit. Calculate and document on the call report the ideal body weight based on measured height/ gender table* • IBW in kg for females = 45.5 + 2.3 x [height in inches-60] • IBW in kg for males = 50 + 2.3 x [height in inches-60] May use measured height from sending facility to calculate if available.	Review most recent chest film and arterial blood gas if available, and confirm ETT in good position as per sending facility CXR or sending MD or radiology report; document confirmation: • If unable to confirm ETT position with CXR as above consider delay time to obtain CXR versus clinical impact to patient in delayed transport Document ETT size and depth at the lips. Confirm serum bicarbonate level from electrolytes, ABG or VBG (require ETCO2 target adjustment if HCO3 < 15 or > 35). Determine if patient has the following: • Normal lung physiology • COPD/Asthma • Lung Injury/ARDS • Severe Metabolic Acidosis

*Ideal Body Weight and Tidal Volumes Charts have been provided in the *Drug Monographs and References* document

Initiating or Maintaining Mechanical Ventilation (continued)

Initiation/Maintenance of Ventilation-Normal lungs

ACP(f)	Mandatory Patch	Start Assist Control. Adjust pressurecontrol or set volume to achieve Vt 6-8 ml/kg. Frequency 10-20/min to achieve ETCO2 of 35-45 mm Hg unless increased ICP= $ETC0_2$ 33-38. Initiate FiO_2 at 1.0 or match FiO_2 from sending facility if available, wean FiO_2 to keep SpO_2 94-98%. Minimum PEEP of 5 for all patients, may increase up to 10 if required to match sending facility ventilator setting or to achieve O_2 saturation target.	If already well ventilated, consider maintaining current setting. Ensure BVM with external PEEP valve and manometer available for duration of transport. Target ETCO2 35-45 unless increased ICP + ETCO2 33-38 Target Vt to 6-8 mL/kg IBW. Adjust PSV/PCV (or set Vt in VC) to obtain Vt target. Adjust RR 10-20 to achieve target ETCO2 once target Vt obtained. NOTE: minimum PSV 8 cm H_2O. Chronically ventilated patients may have PSV as low as 5/5 provided tidal volume according to IBW is maintained. Must maintain plateau/peak airway pressure < 30 cm H_20 with adjustments. **Alarm Guidelines** Set High pressure 5-10 cm H_20 above the PIP. Set Low pressure alarm 5-10 cm H_20 below PIP. Set minute ventilation alarm at 75% of actual VE.
CCP	No Patch Required	Titrate FiO_2 and PEEP to achieve O_2 sat 94-98% target (88-92% if known CO_2 retainer and matches target at sending facility). Adjust inspiratory time to achieve I:E ratio between 1:1.5 and 1:3.0 (may use longer I time to improve mean airway pressure and subsequently oxygenation, shorter I time if obstructive airway disease). Adjust sensitivity to trigger with respiratory effort (default is 3 lpm). PIP < 30 cm H_20. Plateau < 30 cm H_20. DeltaP (PPlat - PEEP) < 15 cm H_2O	

Initiating or Maintaining Mechanical Ventilation (continued)

Monitoring

≥ ACP(f)	Record and monitor the following ventilator parameters: • Target Vt/IBW • Pressure or Volume control • AC/SIMV/PSV • Sensitivity • Frequency • Tidal volume • Minute ventilation • PEEP • Pressure support • Inspiratory time • I:E ratio • ETCO2 • FiO2 • Peak Inspiratory Pressure • Mean Airway Pressure	Monitor ETCO2 and capnographic waveforms throughout transport. Monitor mean arterial pressure changes related to potential ventilator changes during transport. Consider checking plateau pressure and/or auto PEEP if concerned about lung compliance or air trapping. NOTE: to perform either maneuver requires an apneic patient

Cuff Pressures

≥ ACP(f)	Maximum cuff pressure = 20-30 cm H_2O OR Minimum Occluding Volume (MOV) -inflate until you hear no leak at PIP	Tracheal perfusion pressure = $\frac{30\text{mmHg (arterial)}}{18\text{mmHg (venous)}}$ Recommended cuff pressure is just enough to seal the trachea at PIP/MOV. Check cuff pressure using a manometer. Palpating the pilot balloon is not an acceptable determination of cuff pressure.

Clinical Considerations/Notes:

- Not applicable

Guidelines - Mechanical Ventilation

COPD/Asthma Ventilation Strategies

To prevent or treat autoPEEP Use low to normal frequency (8-12 breaths/min). Titrate frequency to maximize I:E ratio > 1:4 – 1:5 allowing for long expiratory time. Use low tidal volume 4-6 mL/kg of ideal body weight. PEEP 5 cm H_2O Adjust inspiratory time $\leq$ 1.0 second (0.7-1.0). Keep Plateau Pressure < 30 cm H_20. Titrate parameters to achieve $Sp0_2$ 91%-94% or in keeping with patient's baseline status.	Severe airway obstruction may not allow complete expiration prior to the next delivered breath. Severe airway obstruction may result in PIPs > 30 cm H2O to achieve target Vt 4-6 ml/kg IBW Intrinsic or autoPEEP develops, leading to worsening hypoxia, hypercapnea and hypotension. Monitor capnographic waveform for sloped expiratory rise indicating airflow obstruction. Consider Salbutamol & Ipratropium Bromide via MDI.

If Difficult to ventilate or oxygenate consider: Permissive hypercapnia Consider matching auto-PEEP; i.e. set PEEP to 2-3 cm H2O < then measured autoPEEP	• Consider use of Magnesium Sulfate IV infusion • Consider Ketamine IV infusion • Consider paralysis • Optimize analgosedation and paralysis in combination with above therapies

Guidelines - Mechanical Ventilation (continued)

Acute Lung Injury/ARDS Ventilation Strategies

Initial frequency 20-26/min. Adjust to maintain target ETCO2.

Initial Vt 6 mL/kg. Adjust Vt based on plateau pressures:

- If plateau > 30 cmH_20 then decrease Vt to 4-5 ml/kg
- If plateau < 30 cmH_20 then Vt may be increased to maximum 8 ml/kg

Start with FIO_2 of 1.0 and PEEP of 5-8 cm H_20

- If SpO_2 >98% then decrease FIO_2;
- If SpO_2 < 90% then increase PEEP to 10 and then incrementally by 2 cm H_20 to maximum of 20.Refer to the ARDSnet PEEP/FiO2 table

Check tidal volume with every adjustmentmadeto pressure control and PEEPsettings. Watch for drop in Vt indicating potential excessive PEEP).

VC: Check peak/ plateau pressure with every change in PEEP and tidal volume.

Keep plateau pressure < 30 cm H_20.
Keep Driving Pressure (DeltaP, Plat-PEEP) < 15 cm H_2O

Minimize FIO_2 ideally < 0.60.

Adjust PEEP ideally above lower inflection point and/or to achieve SpO_2 > 92%.

Allow for permissive hypercapnia.
ETCO2 45-80 mm Hg (based on ABG target pH 7.20-7.25).

Inflamed lungs with decreased compliance and increased dead space are prone to atelectasis, barotrauma and volutrauma.

Do not decrease tidal volumes below 4 mL/kg

Increased I:E ratio can improve oxygenation by increasing mean airway pressure and helping to maintain PEEP.

I:E ratio's < 1:2 should be considered. For example:

- 1:1.8
- 1:1.6
- 1:1.4
- 1:1.2
- 1:1.0

PEEP/FIO_2 Table for patients with ARDS

Simplified table (minimum target PEEP for increased FiO_2)								
FiO_2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
PEEP	5	5	6	8	10	12	14	16
Use this table for guidance when addressing ongoing hypoxia and increasing oxygenation support, **do not** use for initial ventilator settings								

Lung Volume Recruitment (LVR)

≥ CCP | Mandatory Patch

Lung Volume Recruitment (LVR)

Recruitment Maneuver (RM) criteria
Severe ARDS: P/F ratio ≤ 100; with
Diffuse changes on CXR; with
Decrease in lung compliance; ie elevated plateau pressure

Patient meets RM criteria
Is the patient supported on a critical care ventilator & the sending clinical staff physician &/or RT are present and familiar/experienced with the 40/40 RM?

YES

1. Administer a 20 mL/kg Ringers Lactate bolus if there is evidence of hypotension resulting from intravascular volume depletion
2. Leave patient on hospital critical care ventilator. Request RT to perform a 40/40 maneuver; i.e. sustained 40 cm H_2O for 40 seconds, as per hospital protocol
3. Sedate the patient (with addition of paralysis if necessary to suppress respiratory drive despite adequate sedation) to a state of apnea

Abort the RM if:
- MAP decreases by 20% or SBP decreases to ≤ 80 mm Hg, or
- Absolute drop in SpO_2 > 10 points from baseline, or
- Appearance of cardiac dysrhythmias

FOLLOWING the RM
REMEMBER, to clamp the ETT prior to and during ventilator disconnect
1. Transfer the patient to the LTV 1200
2. Establish assisted ventilation with the LTV 1200 in Assist Control (AC) Pressure Control (PC) target Vt 4-6 mL/kg, PIBW (predicted ideal body weight)
3. Establish level of PEEP: increase the PEEP by 2-4 cm H_2O above the pre-RM PEEP setting. Monitor to ensure that SpO_2 gains achieved during the RM are maintained or improve. Also monitor for drop in Vt indicating over distension at higher PEEP setting
4. If the SpO_2 decreases to ≤ 90% and hemodynamics remain acceptable (refer to "Abort the RM" criteria). Repeat the RM, following which increase the PEEP by an additional 2 cm H_2O above that established in #3
5. Incrementally adjust PEEP and wean FiO_2 using PEEP/FiO_2 ARDSNet table as a guide, and as tolerated by improving oxygen saturation

NO

REMEMBER, to clamp the ETT prior to and during the ventilator disconnect.
1. Connect patient to the LTV 1200 ventilator.
2. Administer a 20 ml/kg Ringers Lactate bolus, if there is evidence of hypotension resulting from intravascular volume depletion
3. Sedate the patient (with addition of paralysis if necessary to suppress respiratory drive despite adequate sedation) to a state of apnea
4. Set the FiO_2 = 1.00
5. Set PEEP to 20 cm H_2O
6. Set Pressure Control to 20 cm H_2O; achieving a PIP = 40 cm H_2O
7. Adjust respiratory rate suitable for patient's ventilation requirements
8. Adjust Ti to achieve an I:E ratio = 4:1
9. Maintain this ventilation pattern for 1– 3 minutes based on patient tolerance

Abort the RM if:
- MAP decreases by 20% or SBP decreases to ≤ 80 mm Hg, or
- Absolute drop in SpO_2 > 10 points from baseline, or
- Appearance of cardiac dysrhythmias.

Following RM Continue with #2

Non-Invasive Positive Pressure Ventilation (NPPV)

Indications:

- Conscious patient able to protect airway in respiratory distress

Contraindications:

- NPPV is contraindicated in patients with active vomiting and in those that are unable to manage airway secretions
- Decreased level of consciousness/severe agitation
- Inability to protect airway
- Repeated hemoptysis
- Cardiac arrest or respiratory arrest
- Immediate need for endotracheal intubation
- Upper airway obstruction
- Facial trauma
- Recent esophagostomy

Relative Contraindications:

- Hemodynamic instability

Treatment:

≥ ACP(f)	Initiate then Patch	**Initiation of CPAP/NPPV**
		Initial Setting iPAP 10 cmH_2O/ePAP 5 cm H_2O MAX iPAP 20 cmH_2O/ePAP 10 cmH_2O

≥ ACP(f)	Initiate then Patch	**Maintenance of NIPPV Initiated By Sending Facility**
CCP	No Patch Required	Patient's hemodynamics and ventilation status stable on current settings

Clinical Considerations/Notes:

- **Patch first if** the patient has altered mentation or is lethargic
- NIPPV may be of benefit in hypercarbia from ventilatory failure even with altered mental status
- For agitated patients consider TMP discussion for sedation

Understanding the numbers:

- **iPAP =** Inspiratory Positive Airway Pressure (Peak inspiratory pressure - PIP). iPAP is the sum of PEEP and PS; e.g. if the PEEP = 5 and you set a PS of 10, the resultant iPAP = 15
- **ePAP =** Expiratory Positive Airway Pressure (PEEP)
- **Pressure Support =** the difference between iPAP & ePAP
- **CPAP =** when iPAP equals ePAP (example: CPAP 5=PS 0/PEEP 5)

Adult High Flow Nasal Cannula Therapy (HFNC)

Indications:

- Refractory hypoxemia despite optimized conventional nasal cannula and/or non-rebreather mask O2 therapy in individuals with an intact, acceptable respiratory drive
  - Adults: SpO2 <90%
- COPD/CHF exacerbation requiring a minimal amount of PEEP
- Palliative respiratory support with no endotracheal intubation or non-invasive ventilation (NIV) support in the care plan

Contraindications:

- A definitive airway is required for airway protection and/or respiratory support characterized by acute respiratory acidosis
- Complete nasal airway obstruction
- Use with caution if there is a history of facial trauma, acute sinusitis or otitis

Complications:

- Unmeasured PEEP may result in pneumothorax or lung hyperinflationTreatment:

≥ ACP(f)	Initiate then Patch	Initiate treatment at 30 lpm and titrate flow and FiO2 to achieve SpO2 ≥ 94%

Clinical Consideration/Notes:

Prior to transport perform a 10 minute trial period off HFNC, using a NRB ± conventional NC to determine patient tolerance when AC power is not available for HFNC; e.g. transfer between ambulance and hospital. A successful trial is confirmed by patient SpO2 ≥ 88%. If battery power is not a concern, there is no requirement to conduct this trial.

Ornge Clinical Practice Guideline: Inhaled Epoprostenol Sodium (Flolan)

Background

Epoprostenol (Flolan®) is a prostaglandin I2 (PGI2) which inhibits platelet aggregation and is a potent vasodilator. When administering epoprostenol via inhalation, it results in selective pulmonary vasodilation to areas ventilated as these are the areas where the drug is delivered to. This results in improved ventilation/perfusion matching, reduced pulmonary artery pressures, improved right ventricular (RV) function, and decreased hypoxemia. Pulmonary vasodilators have been used in refractory acute respiratory distress syndrome (ARDS). This is reserved as a rescue and temporizing measure along with other higher evidence interventions (such as prone ventilation). Inhaled epoprostenol is a cost effective alternative to inhaled nitric oxide therapy.

A favourable response to therapy is typically defined as:

- ≥20% improvement in PaO2 or P/F ratio, or
- ≥15% reduction in mean pulmonary artery pressure, and/or
- ≥15% increase in cardiac output

An unfavourable response to therapy is typically defined as:

- <20% improvement in PaO2 or P/F ratio, or
- <15% reduction in mean pulmonary artery pressure, and/or
- <15% increase in cardiac output

Typical dosage range

- 0 – 50 ng/kg/min (ideal body weight)
- Inhaled epoprostenol is usually started at the maximum dose and titrated by 10-20 ng/kg every hour depending on response

Precautions

- Acute discontinuation of the medication can result in **rebound pulmonary vasoconstriction**. This effect usually presents itself within 30 minutes of discontinuation of the medication. If inhaled epoprostenol is weaned or discontinued prior to crew arrival, ensure that the ventilatory parameters remain **stable for at least 30 minutes prior to transport**. Epoprostenol should always be weaned slowly to avoid rebound pulmonary vasoconstriction.
- Systemic **hypotension,** because of the vasodilatory properties, is possible but has not been directly linked with typical dosage ranges of inhaled epoprostenol (0-50 ng/kg/min)
- **Bleeding**, due to inhibition of platelet aggregation, is possible but has not been directly linked with typical dosage ranges of inhaled epoprostenol (0-50 ng/kg/min). Administration should be **avoided during active hemorrhage (especially pulmonary hemorrhage)**.
- Epoprostenol may act as a **pulmonary irritant** due the solutions' alkaline pH (10.2 to 10.8). Care must be taken to avoid accidental spillage into the trachea. Because of this, use with caution in patients with **reactive airways/bronchospasm**.
- **Volume overload/pulmonary edema** has been reported from increased flow. Careful consideration and caution should be taken in this patient population.
- Epoprostenol is **photosensitive**. The medication will need to be shielded from light.
- Due to the **viscosity** of the diluent, the filters can become **sticky and blocked**. If this happens, auto-PEEPing can occur. Filters on the ventilator need to be changed frequently (typically Q4H to QShift on double limb ICU vent circuits). **For the LTV1200, filters should be changed approximately every 2 hrs to ensure consistent drug delivery and to avoid auto-PEEPing**.

Ornge Clinical Practice Guideline: Inhaled Epoprostenol Sodium (Flolan) (continued)

Procedure (for single limb ventilator circuit setup)

1. Determine the dose of inhaled epoprostenol the patient is currently receiving, last titration, and any hemodynamic or ventilatory changes (improvement or worsening) with the inhaled vasodilator therapy, and latest arterial blood gases (pre- and post-initiation/dose change).
2. Patch to TMP to obtain orders to maintain inhaled epoprostenol for transport (**dose titration should not be attempted in transport** unless specifically directed and discussion by TMP with sending MD).
3. Review sending facility infusion/nebulizer setup for inhaled epoprostenol and familiarize with the nebulizer device and functionality. Keep the nebulizer device plugged in and/or bring a backup setup in the event the battery runs out.
4. Ensure an adequate amount of epoprostenol is obtained from sending facility and that the medication is shielded from light.
5. Place two filters (HMEs in series) and connect to the LTV circuit at the distal end of the expiratory limb; place one HME at the proximal end of the inspiratory limb.
6. Connect the nebulizer circuit between the inspiratory limb HME and inspiratory limb circuit.
7. If prolonged transport or delays, **filters should be changed every 2 hours** to avoid auto-PEEPing due to viscosity of the reconstituted mediation.

Inhaled Epoprostenol (Flolan®)

Indications:

- Severe ARDS with refractory hypoxemia
- Pulmonary hypertension
- Right heart failure

Contraindications:

- Severe left ventricular systolic dysfunction
- Pulmonary hemorrhage

Relative Contraindications:

- Thrombocytopenia (platelets <50 x 10^9/L)
- Active hemorrhage
- Pulmonary edema
- Hypotension

Treatment:

	Inhaled Epoprostenol (Flolan®)
≥ CCP Mandatory Patch	0-50 nanograms (ng)/kg/min nebulized* (*FIXED RATE - SHOULD NOT be titrated during transport)

Transport of Patients in the Prone Position

Indications

- Severe ARDS (P:F <150), FiO2 >0.6, and PEEP >5 cmH20 with failed supine ventilation

General Principles

- Mechanically ventilate as per Ornge Clinical Practice Guidelines for ARDS
- Maintain Sedation and Analgesia as per Ornge Sedation and Pain Management of Ventilated Patients Guidelines to target a sedation score of -4 (i.e., deep sedation)
- Maintain paralysis during transport (see below)

Prone Transfer:

		Transport of Patients in Prone Positioning
CCP	Mandatory Patch	Follow Prone-to-Prone Transfer Process as outlined in the Prone Ventilation Operational and Clinical Guidelines

Paralysis:

		Rocuronium
CCP	No Patch Required	0.6 mg/kg IV to initiate paralysis Then 0.3 mg/kg IV q 20 minutes AND/OR 10-15 microgram/kg/min to maintain paralysis

		Cisatracurium
CCP	No Patch Required	0.1 - 0.2 mg/kg IV to initiate paralysis then 0.03 mg/kg IV q 30 minutes AND/OR 1-10 microgram/kg/min to maintain paralysis (usual starting dose 3 microgram/kg/min after initiating paralysis

Cardiac Arrest in Prone Position

- In the event of cardiac arrest, if the rhythm is shockable, defibrillation should be initiated immediately. Ensure defibrillation pads are applied in an interior-posterior orientation prior to initiating transport
- CPR will be performed in the prone position and the paramedic team should not attempt to return the patient supine to do chest compressions
- The decision of transporting a prone patient will be made in conjunction with the TMP, sending physician, and/or receiving physician and the best attempt made to inform the substitute decision maker of the risks and limitations of the transport

Analgosedation and Paralysis

Pre-Transfer Anxiolysis

Indications:

For a patient demonstrating or verbalizing the symptoms of transfer anxiety and:

- GCS of 15
- MAP ≥ 70 mmHg
- No concurrent sedation or parenteral analgesia being administered

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(f) / No patch required	**LORazepam (Ativan)**
	1 mg PO/SL MAX dose 1 mg

Clinical Considerations/Notes:

- Not applicable

Agitated/Combative Patient

Indications:

- In the event that a patient becomes agitated or combative, thereby endangering themselves or crew, ALL Paramedics are expected to: Physically restrain the patient as per MOHLTC Basic Life Support - Patient Care Standards
- Assess the patient for medical causes of agitation (i.e. hypoxemia, hypoglycemia, etc.)

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

Mild-Moderate Agitation

≥ ACP(L) Initiate Then Patch	**Midazolam (Versed)**
	MAP > 70 0.05 mg/kg IV/IO **OR** 0.1 mg/kg IM q 5 minutes prn MAX dose 0.2 mg/kg IV/IM/IO

Severe Agitation/Combativeness

≥ ACP(f) Initiate Then Patch	**Ketamine**
	1-2 mg/kg IV/IO*over 1-3 minutes **OR** 3-5 mg/kg IM

*High IV doses of Ketamine should be given slow push (over ≥ 1 minute) to reduce risk of apnea
***Consider administering using a 50 ml NS bag over 5-10 minutes**

Primary psychiatric diagnosis

≥ ACP(f) Mandatory patch	**Haloperidol (Halodol)**
	2.5 mg - 5.0 mg IV every 5-10 minutes *to a Maximum of 30 mg* or 10 mg of Haloperidol IM (repeat, if required, x1 and patch with TMP)

NOTE: In patients ≥ 65 years of age, start with 2.5 mg

Clinical Considerations/Notes:

- In patients with a primary psychiatric diagnosis, if time permits, contact TMP for Haloperidol (Haldol TM)
- Notify the Flight Crew immediately if in an aircraft

Analgesia: Moderate to Severe Pain

Indications:

- All patients should be assessed for level of pain using a 10 point scale
  (0 = no pain while 10 = maximum pain)

  At least two scores should be documented on all patients and a score must be documented before and after analgesia is provided to the patient

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

Patch when maximum amount given or for any other concerns

≥ PCP(f) / No Patch Required	
	Ibuprofen (Advil) Contraindication: Impaired renal function, active bleeding, NSAID in the past 4-6 hours
	≥ 12 years 400 mg PO

AND/OR

≥ PCP(f) / No Patch Required	
	Acetaminophen (Tylenol) Contraindication: Acetaminophen within the last 4 hours
	40 to 60 kg 15 mg/kg PO/PR q 4 hours prn **≥ 60 kg** 975-1000 mg PO/PR q 4 hours prn MAX 75 mg/kg OR 4 grams in 24 hours

OR

≥ PCP(f) / No Patch Required	
	Toradol (Ketorolac) Contraindication: impaired renal function, active bleeding NSAID in the past 4-6 hours
	15 mg IM

≥ ACP(L) / No Patch Required	
	Toradol (Ketorolac) Contraindication: impaired renal function, active bleeding NSAID in the past 4-6 hours
	15 mg IV/IM

Analgesia: Moderate to Severe Pain (continued)

fentaNYL or Morphine or Ketamine

≥ ACP(L) / No Patch Required	**fentaNYL (Sublimaze)**
	MAP > 70 MAP > 80 (high ICP, ischemic stroke or spinal cord injury) 25-50 microgram IV/IO q 10 minutes prn MAX 300 microgram

OR

≥ ACP(L) / No Patch Required	**Morphine**
	MAP > 70 MAP > 80 (high ICP, ischemic stroke or spinal cord injury) 2-4 mg IV/IO q 20 minutes prn MAX 10 mg

OR

≥ ACP(f) / InitiateThen Patch	**Ketamine** Ketamine is <u>not</u> a first line agent for analgesia in normotensive patients but can be considered early for multiple trauma patients or those with concerning hemodynamic status
	0.1 mg/kg IV/IO q 5 minutes PRN MAX total dose 0.5 mg/kg MAP > 60

Clinical Considerations/Notes:

- Total acetaminophen dose is not to exceed the lesser of a total of 75 mg/kg or 4 grams in 24 hours
- Ketamine for analgesia should be administered slowly using a mini bag or slow IVP if necessary. Adverse events are reduced substantially (46% vs 17%) if given slowly vs IVP.

Ornge Clinical Practice Guideline: Sedation and Pain Management for Intubated and Ventilated Patients

CCPs may administer sedation and analgesia without patching, within the dosage and MAP parameters outlined below. Caution must be taken to avoid sedation/analgesia related hypotension by titrating dosage slowly and to effect utilizing the sedation/analgesia scales below. **ALL intubated patients receiving sedation/analgesia should have a sedation and analgesia score calculated, monitored and documented throughout transport.** Titrate to Ornge Sedation Score -4, to Pain Score 0-2. All patients should receive both analgesia and sedation (Ketamine can be utilized alone if required as it provides both analgesia and sedation). If MAPs drop below the lower boundary then, sedation/analgesia should be reduced or discontinued and action taken to correct the low MAP.

Some clinical conditions require higher MAP parameters to maintain perfusion - utilize a MAP of > 80 as a lower BP parameter for patients with possible increased ICP (TBI, ICH), ischemic CVA, or spinal cord injury.

Pain Scale for Adult Intubated Patients

Critical Care Pain Observation Tool			
Indicator	Description	Score	
Facial Expression	No muscular tension observed	Balanced, neutral	0
	Presence of frowning, brow lowering, orbit tightening and levator contraction	Tense	1
	All of the facial movements plus eyelid tightly closed	Grimacing	2
Body Movements	Does not move at all (does not necessarily mean absence of pain)	Absence of movements	0
	Slow, cautious movements, touching or rubbing the pain site, seeking attention through movements	Protection	1
	Pulling tube, attempting to sit up, moving limbs/thrashing, not following commands, striking at staff, trying to climb out of bed	Restlessness	2
Muscle tension Evaluated by passive flexion and extension of upper extremities	No resistance to passive movements	Relaxed	0
	Resistance to passive movements	Tense, rigid	1
	Strong resistance to passive movements, inability to complete them	Very tense or rigid	2
Compliance with the ventilator (intubated patients) OR Vocalization (extubated patients)	Alarms not activated, easy ventilation	Tolerating ventilator or movement	0
	Alarms stop spontaneously	Coughing but tolerating	1
	Asynchrony: blocking ventilation, alarms frequently activated	Fighting ventilator	2
	Talking in normal tone or no sound	Talking in normal tone or no sound	0
	Sighing, moaning	Sighing, moaning	1
	Crying out, sobbing	Crying out, sobbing	2
Total range			0-8

Source: Am J Crit Care©2006 American Association of Critical-Care Nurses

Ornge Clinical Practice Guideline: Sedation and Pain Management for Intubated and Ven-

Sedation Score for Adults

Richmond Analgesia Sedation Score(RASS)					
Score	Name	General	Ventilator Reaction	ETT Suction Reaction	Paralyzed Reaction
+4	Combative	Danger to staff	Can't ventilate		At rest pupils dilated, ↑↑HR or ↑↑BP
+3	Very Agitated	Requires restraints	Pulls/removes lines, tubes		
+2	Agitated	Can be calmed	Bites ETT, dyssynchrony		
+1	Restless	Apprehensive	Mild distress	Prolonged coughing	
0	Alert, calm	Awakens easily	Tolerating ventilator mostly; needs sedation and analgesia when stimulated and moved	Discomfort, moderate distress, coughing	
-1	Drowsy	Wakes >10s; Follows commands			
-2	Light Sedation	Wakes <10s; Eye contact; Simple commands only		Reaches for ETT, mild distress, coughing	
-3	Moderate Sedation	Moves to voice; No eye contact;	Coughing when moved but tolerates ventilation otherwise	Coughs, mild distress, rapid recovery	Pupils dilate, ↑↑HR or ↑↑BP with external stimulation (1)
-4	Deep Sedation	No response to voice; Moves spontaneously and to physical stimuli;	Tolerates movement well on ventilator	Coughs, not distressed, eyes closed	Minimal or no reaction (pupils, HR, BP) with stimulation (1)
-5	Unarousable	Minimal or no response to voice or noxious stimuli	Minimal or no response to ventilator	No cough, minimal response	

Sedation and Pain Management for Intubated and Ventilated Patients

Indications:

- When a patient is clinically stable, intubated and mechanically or manually ventilated, the ACP(f), and CCP may administer the following for sedation and analgesia

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

Infusions are preferred to repeat bolus dosing for sedation and analgesia wherever possible. A bolus dose of sedation or analgesia should only be considered when infusion dosing is increased and rapid therapeutic effect is required. Caution should be used with bolus dosing as this may increase the risk of sedation induced hypotension. All mechanically ventilated patients should receive analgesia with either Ketamine or FentaNYL.

ACP(f), CCP, PCCP and PCCN may choose and give ONE analgesic along with ONE of the following sedative agents; patch when maximum amount given, or for any other concerns

For Analgesia

≥ ACP(f)	Initiate then Patch	**fentaNYL (Sublimaze) if MAP > 70** (MAP > 80 if high ICP, ischemic stroke or spinal cord injury)	
		50-100 microgram IV/IM prn q 5 minutes *Maximum cumulative dose for the boluses as above cannot exceed* 3 microgram/kg/hr	Initiate IV infusion 1-3 microgram/kg/hr

OR

≥ CCP	No Patch Required	**fentaNYL (Sublimaze) if MAP > 70** (MAP > 80 with high ICP, ischemic stroke or spinal cord injury)	
		50-100 microgram IV/IM prn q 5 minutes MAX dose of 3 microgram/kg/hr	Initiate IV infusion 1-3 microgram/kg/hr

OR

CCP	No Patch Required	**HYDROmorphone IV Infusion**
		Maintenance of continuous IV infusion: 1-60 mcg/kg/hr Usual dosage range: 500-3000 mcg/hr or 0.5-3 mg/hr

For Sedation

≥ ACP(f)	Initiate then Patch	**Midazolam (Versed) if MAP > 70** (MAP > 80 if high ICP, ischemic stroke or spinal cord injury)	
		1-2 mg IV prn q 5 minutes MAX dose 0.15 mg/kg/hr	Initiate IV infusion 0.05-0.15 mg/kg/hr

Sedation and Pain Management for Intubated and Ventilated Patients (continued)

OR

≥ CCP / No Patch Required		
	Midazolam (Versed) if MAP > 70 (MAP > 80 if high ICP, ischemic stroke or spinal cord injury)	
	1-2 mg IV prn q 5 minutes MAX dose 0.15 mg/kg/hr	Initiate IV infusion 0.05-0.15 mg/kg/hr

OR

≥ CCP / No Patch Required		
	Propofol (Diprivan) if MAP > 70 ****Caution in elderly patients **** (MAP > 80 if high ICP, ischemic stroke or spinal cord injury)	
	Bolus	**Infusion**
	Titration of the infusion is preferred however, may give additional boluses of 10-20 mg IV q 5 minutes prn if rapid effect is required, and as long as MAP > 70 mmHg *Exercise caution as bolus doses increase risk of hypotension*	***Titration of the infusion is preferred*** 1-5 mg/kg/hr Titrate in increments of 0.3 mg/kg/hr q 5 minutes prn if MAP > 70

OR

≥ ACP(f) / Initiate then Patch		
	Ketamine if MAP > 60 **(if MAP < 60 Mandatory patch*)** (MAP > 80 if high ICP, ischemic stroke or spinal cord injury)	
	1-2 mg/kg IV over 1 minute x 1 dose followed by 0.5 mg/kg q 20 minutes prn	Continuous IV infusion of 0.3 to 2.0 mg/kg/hr

OR

≥ CCP / No Patch Required		
	Ketamine if MAP > 60 **(if MAP < 60 Mandatory patch*)** (MAP > 80 if high ICP, ischemic stroke or spinal cord injury)	
	1-2 mg/kg IV over 1 minute x 1 dose followed by 0.5 mg/kg q 20 minutes prn	Continuous IV infusion of 0.3 to 2.0 mg/kg/hr

*If MAP < 50 patch to consider other therapies

CCP / No Patch Required	
	DexMEDEtomidine IV Infusion
	Continuous IV infusion: 0.2-1 mcg/kg/hr ***Titration by 0.2 mcg/kg/hour every 30 min until desired sedation goal or clinical effect***

Sedation and Pain Management for Intubated and Ventilated Patients (continued)

Treatment of Hypotension associated with Sedation

CCP	No Patch Required	**Phenylephrine (Neosynephrine)**
		MAP < 65 MAP < 80 (high ICP, ischemic stroke or spinal cord injury) 100 microgram IV/IO X 3 q 3 minutes prn MAX 300 microgram

≥ ACP(f)	Initiate Then Patch	**Norepinephrine (Levophed)**
		0-0.5 microgram/kg/min IV/IO Target MAP > 65

CCP	No Patch Required	**Norepinephrine (Levophed)**
		0-0.5 microgram/kg/min IV/IO Target MAP > 65

Clinical Considerations/Notes:

- All patients (intubated or non-Intubated) receiving analgosedation must be constantly monitored using a continuous ETCO2 gas-sampling device that displays both a value and waveform, and have sedation and pain score documented q 30 minutes throughout transport
- For recurrent hypotension requiring intervention TMP contact is recommended

Post Intubation Paralysis

Indications:

- Patients with known difficult airways
- Facilitate and optimize mechanical ventilation and oxygenation for transport
- **Sedation and Analgesia must be administered in conjunction with muscle relaxation**

Contraindications:

- Allergy or sensitivity to the medication
- Inadequate sedation/analgesia

Treatment:

≥ ACP(f) / Initiate then Patch	**Rocuronium (Zemuron)**
	0.6 mg/kg IV/IO then 0.3 mg/kg IV/IO q 20 minutes prn

CCP / No Patch Required	**Rocuronium IV Infusion**
	Continuous IV infusion: 10 - 15 mcg/kg/min Neuromuscular blocking agent infusions should be titrated to achieve no spontaneous ventilation trigger

CCP / No Patch Required	**Cisatracurium IV Infusion**
	Continuous IV infusion: 1 - 10 mcg/kg/min Neuromuscular blocking agent infusions should be titrated to achieve no spontaneous ventilation trigger

Clinical Considerations/Notes:

- In patients with known difficult airways, muscle relaxation is strongly recommended post intubation to ensure minimal risk for loss of ETT in transport
- Complete history and physical examination (including baseline neurologic assessment) must be completed
- Baseline assessment of vital signs and level of paralysis should be obtained and documented to detect and record the patient's subsequent response to paralysis
- Muscle relaxants will hide the motor component of seizures. In cases of status epilepticus or risk of seizures, use paralysis as a last resort and in conjunction with anticonvulsant/sedative infusions. Monitor for autonomic manifestations of seizures
- Proper securing of the ETT is paramount

Medical Cardiac Arrest and Post Resuscitation Care

Adult Non-Traumatic Cardiac Arrest

Indications:

- Adult patient is vital signs absent (VSA) due to non-traumatic cause

Contraindications:

- Not applicable

Treatment:

≥ PCP(f) Initiate then Patch	**Initiate the appropriate algorithm based upon the presenting ECG rhythm**

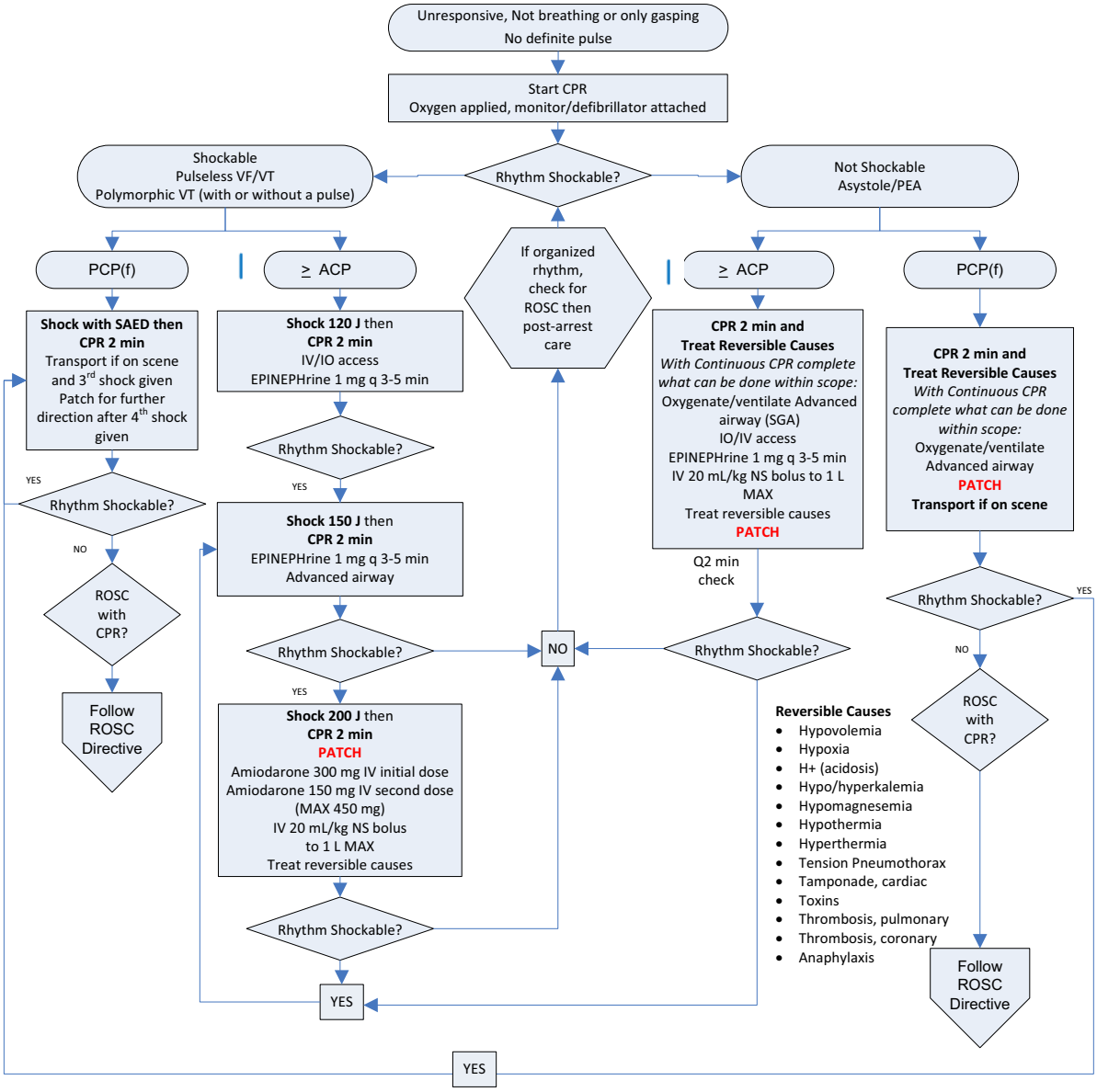
≥ ACP(L) Initiate then Patch	**Initiate the appropriate algorithm based upon the presenting ECG rhythm**

Shock	Zoll X-Adult manual & SAED settings
Shock # 1	120J
Shock # 2	150J
Shock # 3 and all subsequent shocks	200J

Clinical Considerations/Notes:

- PCP(f) may apply the Medical Directives for the management of cardiac arrest with semi-automated defibrillation
- TMP patch prior to initiating transport of patient in cardiac arrest for consideration of TOR

Adult Non-Traumatic Cardiac Arrest (continued)



Return of spontaneous circulation (ROSC)

- Spontaneous pulse and/or art line pressure waveform
- Measurable BP
- Abrupt sustained rise in $ETCO_2$ may be an early indication

CPR Quality

- Push hard (≥ 1/3 chest AP diameter: 5-6 cm depth
- Push fast (100/min-120/min)
- Ensure full chest recoil
- Minimize/avoid interruptions (even for attempts at advanced airway or IV/IO access)
- Rotate compressors q 2 min
- Rounds of CPR are 2 min in duration concentrating on effective CPR/ventilation then checking if rhythm is shockable
- Monitor quality of CPR by pulse
- Avoid excessive ventilation
- 30:2 ratio if no advanced airway
- With advanced airway, 10 breaths/min (ventilate q 6 sec) with continuous compressions

Note:

- **PATCH** with TMP as soon as possible
- Pulse checks are less than 10 seconds. Confirm no definite pulse and no signs of life in less than 10 seconds. Avoid delays or interruptions to CPR
- Rhythm checks are brief (few seconds) to determine if shockable rhythm
- Confirm asystole in 2 leads to differentiate from fine VF

Adult Severe Hypothermic Cardiac Arrest

Indications:

- Adult patient to be vital signs absent (VSA) and Hypothermic defined as temperature < 30^{O}C, or presumed to be so based on environmental circumstances.

Contraindications:

- Not applicable

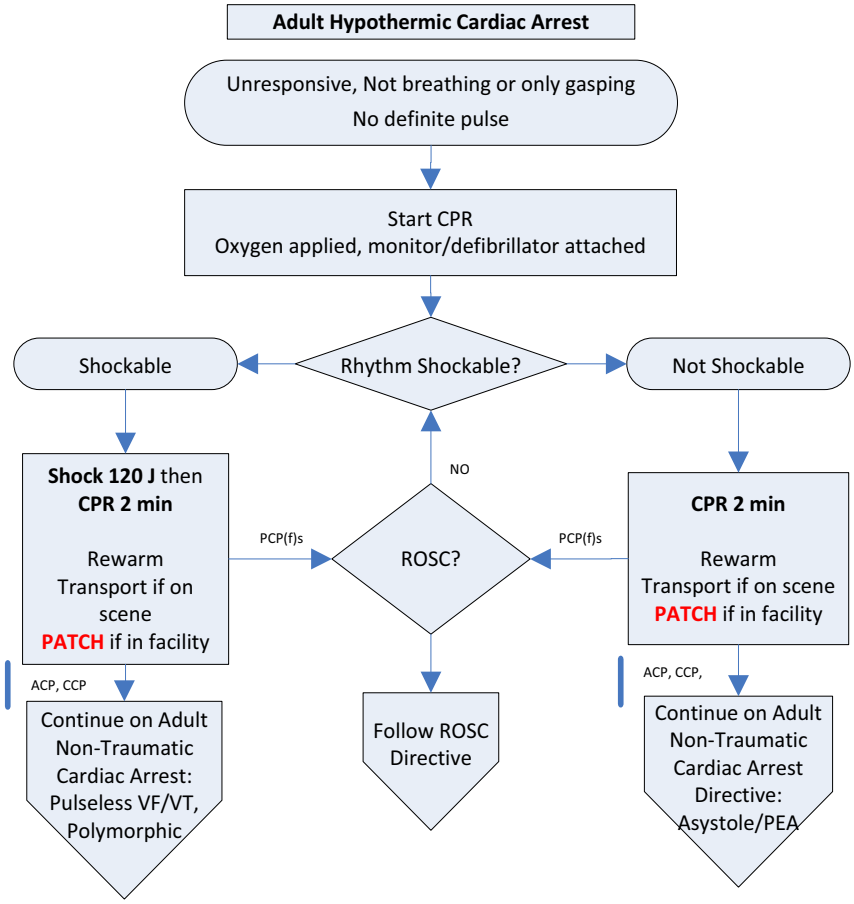
Treatment:

≥ PCP(f)	Initiate then Patch	
		Initiate the appropriate algorithm based upon the presenting ECG rhythm

Clinical Considerations/Notes:

- Not applicable

Adult Severe Hypothermic Cardiac Arrest (continued)



Note:

- Hypothermic Cardiac Arrest: main cause of arrest thought to be due to severe hypothermia where core temperature is known to be <30°C or suspected hypothermia (note that tympanic thermometry is unreliable in severe hypothermia)
- **Treat reversible causes including hypothermia. Rapid transport to the closest appropriate emergency department for aggressive rewarming during resuscitation is key. Rewarm with external heat sources, shelter, and warmed IV fluids (up to 40°C)**
- In hypothermia, pulse and respiratory rate may be slow and difficult to detect and ECG may appear to be asystole. Take up to 10 seconds to determine no perfusing rhythm
- Rhythm checks are brief (few seconds) to determine if shockable rhythm
- Confirm asystole in 2 leads to differentiate from fine VF
- TOR in hypothermic resuscitation will only be considered if the known core temp of the patient is >30°C

PATCH with TMP as soon as possible

CPR Quality

- Push hard (≥ 1/3 chest AP diameter: ≥ 5 cm depth
- Push fast (100/min-120/min)
- Ensure full chest recoil
- Minimize/avoid interruptions (even for attempts at advanced airway or IV/IO access)
- Rotate compressors q 2 min
- Rounds of CPR are 2 min in duration concentrating on effective CPR/ventilation then checking if rhythm is shockable
- Monitor quality of CPR by pulse
- Avoid excessive ventilation
- 30:2 ratio if no advanced airway
- With advanced airway, 10 breaths/min (ventilate q 6 sec) with continuous compressions

Return of spontaneous circulation (ROSC)

- Spontaneous pulse and/or art line pressure waveform
- Measurable BP
- Abrupt sustained rise in $EtCO_2$ may be an early indication

- Rapid evaluation of a 12 lead ECG following return of spontaneous circulation in victims of cardiac arrest to evaluate timing of emergent invasive cardiac procedures[1]
- Transport to a centre capable of performing percutaneous coronary interventions (PCI) for patients who have suffered an out of hospital cardiac arrest[2]
- In patients with hypotension, a combination of crystalloid and vasopressors/inotropic support may be required to maintain adequate end-organ perfusion balanced with avoidance of worsening myocardial oxygen demand in the setting of ischemia/infarction. Target MAP should exceed 65 mmHg[3, 4, 5]
- Core body temperature should be monitored[6] as hyperthermia in the post cardiac arrest setting is associated with increased mortality and should be avoided[7]
- The use of hypothermia or targeted temperature management to maintain core body temperature between 32-36 degrees Celsius is associated with improved neurologic outcome[8, 9] and should be maintained during inter-facility transport. The initiation of cooling is not essential pre-hospital during the cardiac arrest resuscitation or immediately post return of spontaneous circulation (ROSC)[10]
- Adequate sedation and the use of neuromuscular blockade should be considered for patient comfort and to suppress shivering facilitating reaching target temperature[11, 12]
- Hypoxemia as well as hyperoxemia must be avoided as they are associated with lower survival rates. Oxygen administration should be titrated to maintain oxygen saturation values between 94% and 98% or a PaO_2 of approximately 100 mmHg[13, 14]
- Hypocarbia as well as hypercarbia must be avoided. Ventilation should be based upon arterial blood gas measurement. Hyperventilation alone should not be used to compensate for metabolic acidosis as the lactic acidosis is ideally best managed with restoration of adequate perfusion. Ideal target $PaCO_2$ should be maintained at approximate physiologic parameters between 40-45mmHg, target $EtC0_2$ should be maintained between 35-40 mmHg[15, 16] however, further adjustments can be made by the TMP

Adult Post Arrest Return of Spontaneous Circulation (ROSC)

Indications:

- ROSC

Contraindications:

- Not applicable

Treatment:

≥ ACP (L)	Initiate then Patch	**Initiate appropriate treatment based on algorithm below**

Clinical Considerations/Notes:

- Reminder that Targeted Temperature Management (TTM) is Mandatory. Temperatures should be maintained between 34^{O}C and 36^{O}C during TTM
- Document attempts to control temperature
- Maintain temperature 34-36^{O}C, ETC02 35-40 mmHg, SpO2 94-98%

Adult Post Arrest Return of Spontaneous Circulation (ROSC) (continued)

Adult Post Arrest Return of Spontaneous Circulation

Manage as per scope

A. Optimize ventilation and oxygenation

- Maintain oxygen saturation 94-98%
- Consider intubation and ventilation if signs of shock in order to decrease work of breathing demand on cardiac output
- ETCO2 target 35-40 mmHg

B. Manage hypotension (MAP <65)

- Hypovolemic/non-hemorrhagic medical directive
- Patch to optimize vasopressor and vasoactive infusions
- Consider reversible causes (see list on right margin)
- Obtain **12 lead ECG** and consider myocardial ischemia/ infarction requiring ASA and emergent reperfusion therapy

C. Assess neurologic function

- Check GCS
- Check glucometer if altered mentation
- If cooling initiated by sending facility, patch and maintain cooling
- Follow Sedation and Pain Management for Intubated and Ventilated Patients Medical Directive

D. Comatose

Patients with a lack of meaningful response to verbal commands in adult patients with ROSC after cardiac arrest have Targeted Temperature Management (TTM). Temperatures should be maintained between 34°C and 36°C during TTM.

E. Guidelines for TTM

- Insert Esophageal Temperature Probe
- Follow Sedation and Pain Management for Intubated and Ventilated Patients MDSO for target MAP > 65 mmHg
- Consider neuromuscular blockade to prevent shivering

NOTES:

- Hypocarbia as well as hypercarbia must be avoided. Ventilation should be based upon arterial blood gas measurement whenever possible. $ETCO_2$ target 35-40 mmHg however ventilation alone should not be used to compensate for metabolic acidosis
- Follow medical directives and/or patch with the TMP to immediately correct hypotension (systolic BP < 90 mmHg/MAP < 65) during post resuscitation care.
- Coronary angiography should be performed emergently for OHCA patients with suspected cardiac etiology of arrest and ST elevation on ECG therefore consider thrombolytic or transport to a specialized cardiac centre for interventional cardiology.
- If on scene, do not routinely initiate pre-hospital cooling of patients after ROSC with rapid infusion of cold IV fluids

Consider and treat reversible causes

- Hypovolemia
- Hypoxia
- H+ (acidosis)
- Hypo/hyperkalemia
- Hypomagnesemia
- Hyperthermia
- Tension Pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary
- Anaphylaxis

Acquire and interpret **12 LEAD ECG**

Cardiac (Non-Arrest)

Ornge Clinical Practice Guideline: Non ST Elevation MI (NSTEMI)

Please refer to the *Drug Monographs and References* document for references listed in the CPGs

Early Hospital Care: Recommendations

Standard Medical Therapies

1. Oxygen
   Class I
   a. Supplemental oxygen should be administered to patients with NSTEMI with arterial oxygen saturation less than 90%, respiratory distress, or other high-risk features of hypoxemia[37]. Oxygen should be titrated to SpO_2 94-98%
2. Nitrates
   Class I
   a. Patients with NSTEMI with continuing ischemic pain should receive **sublingual nitroglycerin** (0.3 mg–0.4 mg) every 5 minutes for up to 3 doses, after which an assessment should be made about the need for intravenous nitroglycerin if not contraindicated
   b. **Intravenous nitroglycerin** is indicated for patients with NSTEMI for the treatment of persistent ischemia, heart failure (HF), or hypertension (2014 AHA/ACC 106-111) [1-7]
   Class III: Harm
   c. Nitrates should not be administered to patients with NSTEMI who recently received a phosphodiesterase inhibitor, especially within 24 hours of sildenafil or vardenafil, or within 48 hours of tadalafil (2014 AHA/ACC 112-114) [1(19), 8-10]
3. Analgesic Therapy
   Class IIb
   a. In the absence of contraindications, it may be reasonable to administer **Morphine Sulfate or fentaNYL** intravenously to patients with NSTEMI if there is continued ischemic chest pain despite treatment with maximally tolerated anti-ischemic medications (2014 AHA/ACC 115-116) [1, 11, 12]

Initial Antiplatelet/Anticoagulant Therapy in Patients With Definite or Likely NSTEMI

1. Initial Oral and Intravenous Antiplatelet Therapy in Patients with Definite or Likely NSTEMI
   Class I
   a. **Non-enteric-coated, chewable aspirin (160 mg to 325 mg)** should be given to all patients with NSTEMI without contraindications as soon as possible after presentation, and a maintenance dose of aspirin (81 mg/day to 160 mg/day) should be continued indefinitely (2014 AHA/ACC 142-144) [1, 13, 14, 15]
   b. In patients with NSTEMI who are unable to take aspirin because of hypersensitivity or major gastrointestinal intolerance, a loading dose of **clopidogrel** followed by a daily maintenance dose should be administered (2014 AHA/ACC 145) [1(22), 16]
   c. A P2Y12 inhibitor (either clopidogrel or ticagrelor) in addition to aspirin should be given to all patients with NSTEMI without contraindications, and administered for up to 12 months to all patients with NSTEMI without contraindications who are treated with either an early invasive or ischemia-guided strategy. Options include:
      - **Clopidogrel:** 300 mg or 600 mg loading dose, then 75 mg daily
        - 600 mg usually intended for patients who will undergo angioplasty
      - **Ticagrelor**: 180 mg loading dose, then 90 mg twice daily
2. Initial Parenteral Anticoagulant Therapy in Patients with Definite NSTE-ACS
   Class I
   a. In patients with NSTEMI, anticoagulation, in addition to antiplatelet therapy, is recommended for all patients irrespective of initial treatment strategy. Treatment options include:
      - **Enoxaparin**: 1 mg/kg subcutaneous (SubQ) every 12 hours (reduce dose to 1 mg/kg SubQ once daily in patients with creatinine clearance [CrCl] <30 mL/min) until percutaneous coronary intervention (PCI) is performed. An initial intravenous loading dose is 30 mg (2014 AHA/ACC 151-153) [1, 17-19]

Orange Clinical Practice Guideline: Non ST Elevation MI (NSTEMI) (continued)

- **Unfractionated heparin (UFH) IV**: initial loading dose of 60 IU/kg (MAX 4,000 IU) with initial infusion of 12 IU/kg per hour (MAX 1,000 IU/h) adjusted per activated partial thromboplastin time to maintain therapeutic anticoagulation according to the specific hospital protocol until PCI is performed (2014 AHA/ACC 160-166) [1, 20-26]
- **Bivalirudin**: 0.10 mg/kg loading dose followed by 0.25 mg/kg per hour (only in patients managed with an early invasive strategy), continued until diagnostic angiography or PCI, with only provisional use of GP IIb/IIIa inhibitor, provided the patient is also treated with DAPT (2014 AHA/ACC 146,147,154,155) [1, 27-30]
- **Fondaparinux**: 2.5 mg SC daily, continued for the duration of hospitalization or until PCI is performed (2014 AHA/ACC 156-158) [1, 31-33]. If PCI is performed while the patient is on fondaparinux, an additional anticoagulant with anti-IIa activity (either UFH or bivalirudin) should be administered because of the risk of catheter thrombosis (2014 AHA/ACC 157-159) [1, 32-34]

Class III: Harm

a. In patients with NSTEMI (i.e., without ST elevation, true posterior MI, or left bundle-branch block not known to be old), intravenous fibrinolytic therapy should not be used (2014 AHA/ACC 167,168) [1, 35, 36]

Acute Coronary Syndrome

Indications:

- Suspected cardiac ischemia

Conditions for Nitroglycerin Administration

- Patient is ≥ 40 kg
- MAP ≥ 70 mmHg
- Heart rate is ≥ 60 beats and < 160 bpm
- Patient is alert
- Patients under the age of 18 requires a TMP patch

Contraindications for Nitroglycerin Administration:

- Allergy or sensitivity to nitrates
- Patient has used any phosphodiesterase-5 inhibitors (Sildenafil [Viagra or Revatio], tadalafil [Cialis], or Vardenafil [Levitra]) in the last 48 hours (these agents are commonly used for erectile dysfunction and are also used in pulmonary hypertension)
- 12 lead ECG compatible with Right Ventricular MI

Treatment:

≥ PCP(f) / No Patch Required	**Nitroglycerin SL ***
	MAP >70 0.4 mg SL spray q 5 minutes MAX of 6 doses

*Single PCP(f): Initiate then patch

≥ ACP(f) / Initiate then Patch	**Initiate Nitroglycerin IV** **MAP > 70**
	10 microgram/min MAX 100 microgram/min Titrate q 5 minutes in 5 microgram/min increments for ischemic chest pain Maintain Nitroglycerin infusion during transport

≥ ACP(f) / Initiate then Patch	**Maintain Nitroglycerin IV**
≥ CCP / No Patch Required	Maintain nitroglycerin infusion during transport under conditions listed below •The infusion was initiated by the sending facility •The infusion rate is ≤ 100 microgram/min IV •No change in patient condition during transport

≥ PCP(f) / No patch required	Acetylsalicylic Acid (ASA)	
	160 mg PO, chewed and swallowed (two 80 mg chewable tablets)	• No allergy to ASA • No current active bleeding • No evidence of CVA or head injury within 24 hours prior to onset of chest pain • No history of asthma exacerbation from ASA ingestion

Fentanyl is the preferred analgesic for ischemic chest pain.

≥ ACP(L) / No Patch Required	fentaNYL (Sublimaze)
	MAP ≥ 70 25-50 microgram IV/IO q 5 minutes prn MAX 300 microgram

≥ ACP(f) / Mandatory patch	Plavix (Clopidogrel)
	300-600 mg PO

OR

≥ ACP(f) / Mandatory Patch	Ticagrelor
	180 mg PO

≥ ACP(f) / Mandatory Patch	Metoprolol
	5 mg IV/IO q 5 minutes MAX 15 mg If the patient is hypertensive or tachycardic

≥ ACP(f) / No Patch Required	Maintain Heparin*
	Maintain Heparin infusion rate from sending if last PTT within therapeutic range of Ornge or sending hospital nomogram, OR if infusion initiated and no post-initiation PTT available yet

Acute Coronary Syndrome (continued)

≥ ACP(f) / Mandatory Patch	**Initiate Heparin***
	60 units/kg IV bolus MAX 5,000 units then **INITIATE Infusion** 12 units/kg/hr IV Titrate dose relative to aPTT

Heparin Nomogram for Patients <u>NOT</u> Receiving Thrombolytics or Glycoprotein IIb/IIIa Inhibitors				
aPTT (seconds)	Heparin Bolus (units)	Hold Infusion (Minutes)	**Rate Change (units/hr)** **** using 50 units/mL concentration****	Next aPTT (from the time rate was changed)
Less than 50	3,000	0	↑ 2.4 mL/120 units/ hr	4 hours later (STAT)
50-59	0	0	↑2.4 mL/120 units/ hr	6 hours later
60-85	0	0	0	Next AM
86-95	0	0	↓1.6 mL/80 units/hr	Next AM
96-120	0	30	↓ 1.6 mL/80 units/hr	6 hours after restarting
Greater than 120	0	60	↓ 3.2 mL/160 units/hr	4 hours after restarting (STAT)
If aPTT is greater than 120 OR less than 50 x 2 consecutive blood samples, patch TMP				

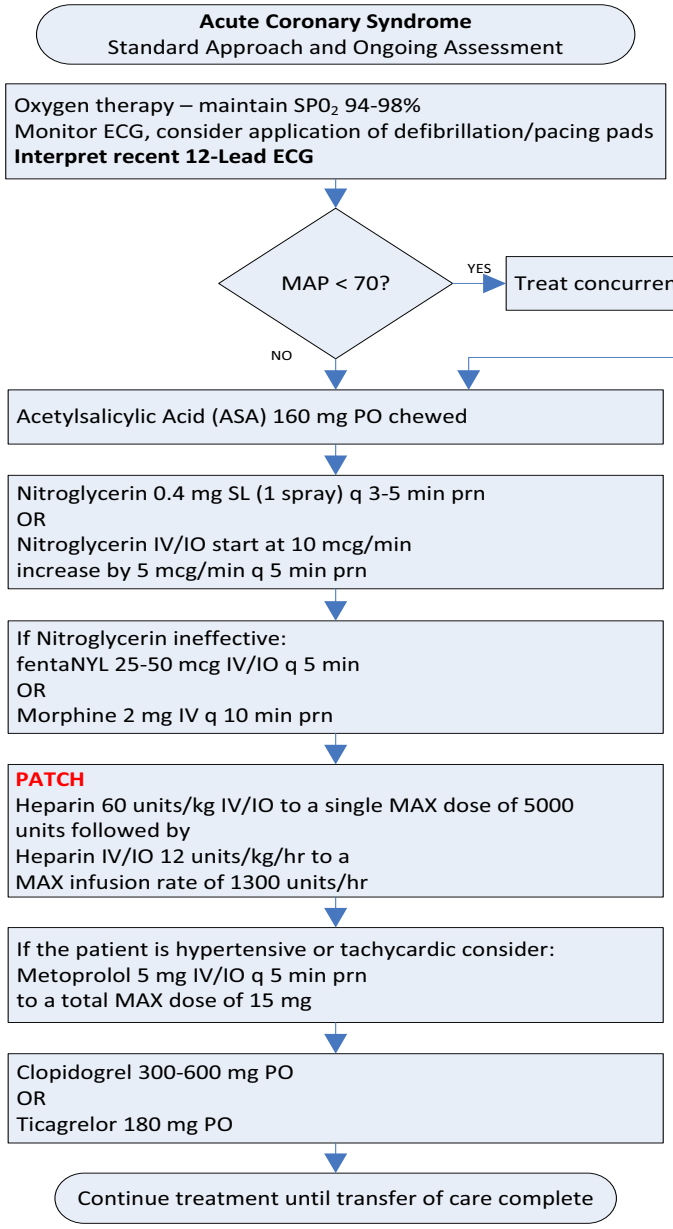
***Contraindications to Heparin:**

- Active bleeding
- History of Heparin induced thrombocytopenia

Clinical Considerations/Notes:

- In the setting of acute coronary syndrome fentaNYL is the preferred analgesic
- Consider Plavix in NSTEMI patients
- Patch if PTT parameters (above) fall outside norm

Acute Coronary Syndrome (continued)



12-Lead ECG

- Repeat ECGs indicated with changes in clinical symptoms and condition
- Communicate changes to relevant physician

Patient Safety Considerations

- Anaphylaxis is the only contraindication for ASA administration
- ASA must be administered even when the patient
  - States that they have already taken their prescribed daily dose
  - States that they have taken ASA on the advice of the post-dispatch instructions
  - Is currently taking blood thinners (e.g., Plavix, warfarin)
- **PATCH** to consider early clopidogrel administration for patients anaphylactic to ASA

Patient Safety Considerations

- Nitroglycerin is contraindicated without TMP consultation in patients with cardiogenic shock

Clopidogrel

- May increase Clopidogrel dose to 600 mg in patients going to cath lab
- May decrease dose to 75 mg in patients > 75 years old receiving thrombolytic

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Reperfusion Therapy

Class I

a. Reperfusion therapy should be administered to all eligible patients with STEMI with symptom onset within the prior 12 hours (2013 ACCF/AHA 16, 17) [1-3]
b. Primary PCI is the recommended method of reperfusion when it can be performed in a timely fashion by experienced operators (2013 ACCF/AHA 17-19) [1, 3-5]
c. Emergency medical services transport directly to a PCI-capable hospital for primary PCI is the recommended triage strategy for patients with STEMI, with an ideal first medical contact (FMC)-to-device time system goal of 90 minutes or less (2013 ACCF/AHA 11, 14, 15) [1, 6-8]
d. Immediate transfer to a PCI-capable hospital for primary PCI is the recommended triage strategy for patients with STEMI who initially arrive at or are transported to a non-PCI-capable hospital, with an FMC-to-device time system goal of 120 minutes or less (2013 ACCF/AHA 18-21) [1, 4, 5, 9, 10]
e. In the absence of contraindications, fibrinolytic therapy should be administered to patients with STEMI at non–PCI-capable hospitals when the anticipated FMC-to-device time at a PCI-capable hospital exceeds 120 minutes because of unavoidable delays (2013 ACCF/AHA 16, 22, 23) [1, 2, 11, 12]
f. When fibrinolytic therapy is indicated or chosen as the primary reperfusion strategy, it should be administered within 30 minutes of hospital arrival.

Class IIa

a. Reperfusion therapy is reasonable for patients with STEMI and symptom onset between 12 to 24 hours who have clinical and/or ECG evidence of ongoing ischemia. Primary PCI is the preferred strategy in this population (2013 ACCF/AHA 16, 19, 30) [1, 2, 5, 13]

Transfer to a PCI-Capable Hospital after Fibrinolytic Therapy

Class I

a. Immediate transfer to a PCI-capable hospital for coronary angiography is recommended for suitable patients with STEMI who develop cardio-genic shock or acute severe HF, irrespective of the time delay from MI onset (2013 ACCF/AHA 128) [1, 14]

Class II

a. Urgent transfer to a PCI-capable hospital for coronary angiography is reasonable for patients with STEMI who demonstrate evidence of failed reperfusion or reocclusion after fibrinolytic therapy (2013 ACCF/AHA 129-132) [1, 15-18]
b. Transfer to a PCI-capable hospital for coronary angiography is reasonable for patients with STEMI who have received fibrinolytic therapy even when hemodynamically stable and with clinical evidence of successful reperfusion. Angiography can be performed as soon as logistically feasible at the receiving hospital, and ideally within 24 hours, but **should not be performed within the first 2 to 3 hours after administration of fibrinolytic therapy** (2013 ACCF/AHA 133-138) [1, 19-24]

Standard Medical Therapies with PCI

1. Oxygen
   Class I
   a. Supplemental oxygen should be administered to patients with STEMI with arterial oxygen saturation less than 90%, respiratory distress, or other high-risk features of hypoxemia[53]. Oxygen should be titrated to SaO_2 94-98%

2. Antiplatelet Therapy to Support Primary PCI for STEMI
   Class I

a. **Aspirin 162 to 325 mg** should be given before primary PCI (2013 ACCF/AHA 74-76) [1, 25-27]

3. A loading dose of a P2Y12 receptor inhibitor should be given as early as possible or at time of primary PCI to patients with STEMI. Options include:
   a. **Clopidogrel 600 mg** (2013 ACCF/AHA 76, 81, 82) [1, 27, 28]; or
   b. **Prasugrel 60 mg** (2013 ACCF/AHA 83) [1, 30]; or
   c. **Ticagrelor 180 mg** (2013 ACCF/AHA 84) [1, 31]

4. Anticoagulant Therapy to Support Primary PCI
   Class I
   a. For patients with STEMI going for primary PCI, the following supportive anticoagulant regimens are recommended:
      i **UFH**, with additional boluses administered as needed to maintain therapeutic activated clotting time levels, taking into account whether a glycoprotein IIb/ IIIa receptor antagonist has been administered; or
      ii **Bivalirudin** with or without prior treatment with UFH (2013 ACCF/AHA 109) [1, 32]

1. Reperfusion at a Non–PCI-Capable Hospital: Recommendations
   Class I
   a. In the absence of contraindications, fibrinolytic therapy should be given to patients with STEMI and onset of ischemic symptoms within the previous 12 hours when it is anticipated that primary PCI cannot be performed within 120 min. of FMC (2013 ACCF/AHA 16, 111-116) [1, 2, 33-38]

   Class IIa
   a. In the absence of contraindications and when PCI is not available, fibrinolytic therapy is reasonable for patients with STEMI if there is clinical and/or electrocardiographic evidence of ongoing ischemia within 12 to 24 hours of symptom onset and a large area of myocardium at risk or hemodynamic instability.

   Class III: Harm
   a. Fibrinolytic therapy should not be administered to patients with ST depression except when a true posterior (inferobasal) MI is suspected or when associated with ST elevation in lead aVR (2013 ACCF/ AHA 16, 117-120) [1, 2, 39-42]

Standard Medical Therapies with Fibrinolysis

1. Adjunctive Antiplatelet Therapy With Fibrinolysis
   Class I
   a. **Aspirin (162- to 325-mg loading dose) and clopidogrel (300-mg loading dose for ≤75 years of age, 75-mg dose for patients >75 years of age**) should be administered to patients with STEMI who receive fibrinolytic therapy (2013 ACCF/AHA 113, 121, 122) [1, 35, 43, 44]
2. Adjunctive Anticoagulant Therapy with Fibrinolysis
   Class I
   a. Patients with STEMI undergoing reperfusion with fibrinolytic therapy should receive anticoagulant therapy until revascularization is performed (2013 ACCF/AHA 123, 124) [1, 45, 46]

Recommended regimens include:

1. **UFH** administered as a weight-adjusted intravenous bolus and infusion to obtain an activated partial thromboplastin time of 1.5 to 2.0 times control, until revascularization;
2. **Enoxaparin** administered according to age, weight, and creatinine clearance, given as an intravenous bolus, followed in 15 minutes by subcutaneous injection until revascularization (2013 ACCF/AHA 124-127) [1, 46-49]; or

3. **Fondaparinux** administered with initial intravenous dose, followed in 24 hours by daily subcutaneous injections if the estimated creatinine clearance is greater than 30 mL/min, until revascularization (2013 ACCF/AHA 110) [1, 50]

Beta Blockers

Class IIa

a. IV B-Blocker therapy may be considered as reasonable in specific situations such as severe hypertension or tachyarrhythmia in patients without contraindications (Class IIa LOE B) [52]

Nitrates

1. Although nitroglycerin can ameliorate symptoms and signs of myocardial ischemia by reducing LV preload and increasing coronary blood flow, it generally does not attenuate the myocardial injury associated with epicardial coronary artery occlusion unless vasospasm plays a significant role. Intravenous nitroglycerin may be useful to treat patients with STEMI and hypertension or Heart Failure. Nitrates should not be given to patients with hypotension, marked bradycardia or tachycardia, RV infarction, or phosphodiesterase inhibitor use within the previous 24 to 48 hours (2013 ACCF/AHA 444) [1, 51]

ST Elevation MI (STEMI)

Indications:

- STEMI as defined by ECG changes

Contraindications:

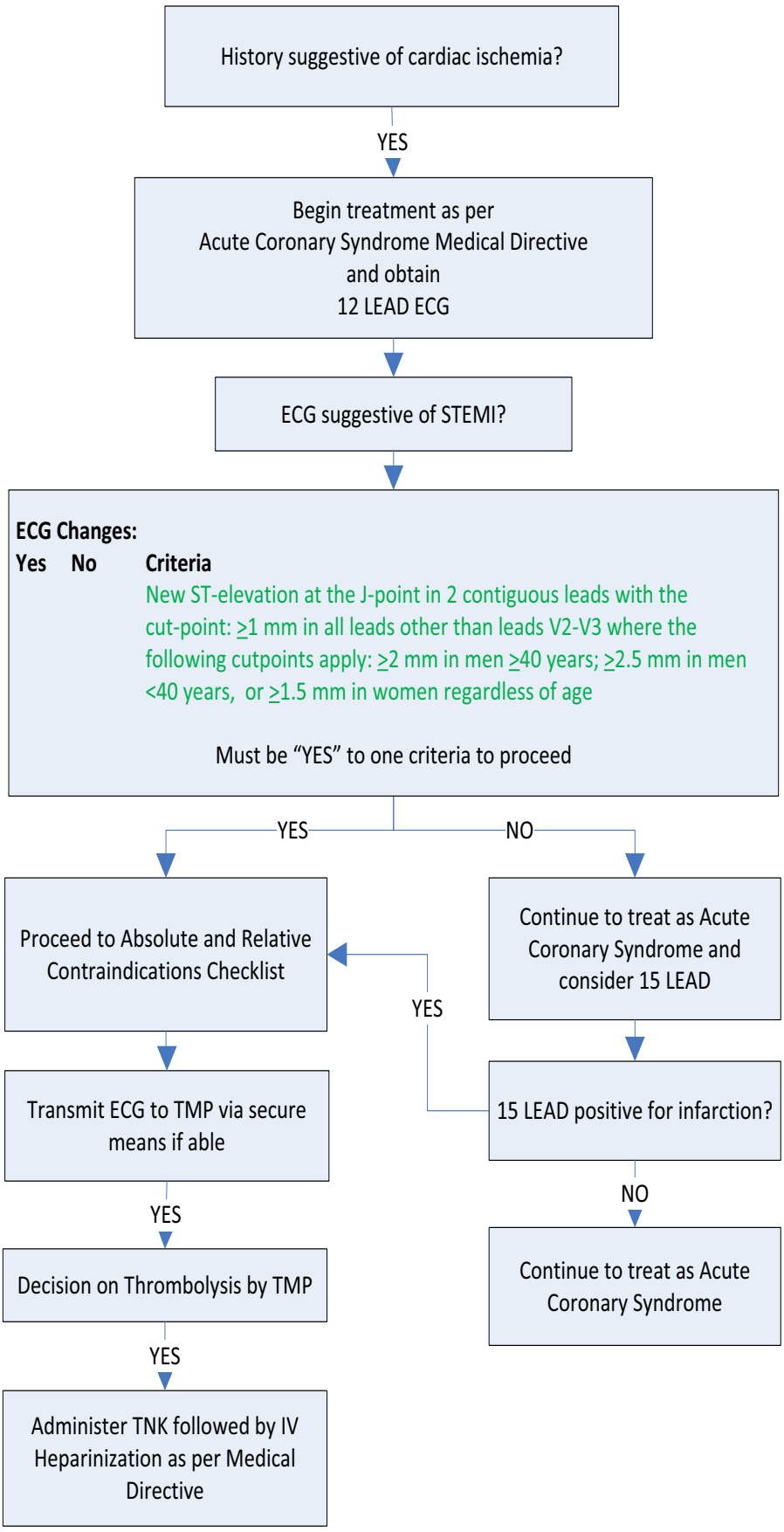
- See list next page

Treatment:

In patients being transported for acute cardiac intervention (emergent PCI) initiate Medical Directive and load and go. Initiate patch in transport or pre-patch prior to arrival whenever possible.

≥ ACP(f)	Initiate then Patch	**Initiate appropriate treatment based on algorithm below**

ST Elevation MI (STEMI) (continued)



ST Elevation MI (STEMI) (continued)

Contraindications to Thrombolytics

Yes	No	Absolute Contraindications Criteria
		• Suspected Aortic Dissection
		• Any prior intracranial hemorrhage, hemorrhagic stroke, or stroke of unknown origin
		• Known structural cerebral vascular lesion (i.e. arteriovenous malformation)
		• Known intracranial neoplasm (primary or metastatic)
		• Ischemic stroke > 3 hours or < 3 months
		• Suspected pericarditis
		• Active bleeding or bleeding diathesis (excluding menses)
		• Gastrointestinal bleeding within the last month
		• Major trauma/surgery/head injury within three months
*** Must be "No" to all Absolute Criteria to proceed**		
Yes	**No**	**Relative Contraindications**
		• Patient within 90 minutes of PCI centre from scene, consider direct transport for PCI OR • 120 minutes from PCI centre if in a community hospital
		• History of chronic, severe, poorly controlled hypertension
		• Severe uncontrolled hypertension on presentation (SBP greater than 180 mmHg or DBP > than 110 mmHg)†
		• History of prior ischemic stroke or transient ischemic attack within six months, dementia, or known intracranial pathology not covered in contraindications
		• Traumatic or prolonged CPR (> than ten minutes)
		• Recent internal bleeding (within two to four weeks)
		• Noncompressible vascular punctures
		• Advanced liver disease
		• Pregnancy or within one week postpartum
		• Infective endocarditis
		• Active peptic ulcer
		• Current use of anticoagulants: the higher the INR, the higher the risk of bleeding
SBP = systolic blood pressure DBP = diastolic blood pressure INR = international normalized ratio MI = myocardial infarction †Could be an absolute contraindication in low-risk patients with MI		
*** Must have this information available for the TMP to help weigh risk/benefit of thrombolytic therapy**		

Clinical Considerations/Notes:

- No thrombolysis will be administered unless the TMP confirms diagnosis based on clinical and ECG findings and gives the order to proceed. It is preferred that the TMP reviews the ECG but if not possible and paramedic is confident of positive ECG criteria then a verbal confirmation on patch with TMP is adequate
- Obtain 12 Lead ECG every 15 minutes or prn for duration of transport

ST Elevation MI (STEMI) (continued)

Thrombolytics (TNKase and Heparinization)

≥ ACP(f) / Mandatory Patch	TNKase		
	Patient's Weight (kg)	**Tenecteplase (mg)**	**Volume (mL)**
	< 60 kg	30	6 ml
	≥ 60 to < 70 kg	35	7 ml
	≥ 70 to < 80 kg	40	8 ml
	≥ 80 to < 90 kg	45	9 ml
	> 90 kg	50	10 ml

≥ ACP(f) / Mandatory Patch	**Initiate Heparin*** *Concurrent Use When Thrombolytics Given:*
	60 units/kg IV bolus MAX 4,000 units then **INITIATE Infusion** 12 units/kg/hr IV MAX 1,000 units/hr Titrate infusion using Heparin Nomogram

Heparin Nomogram for Patients who HAVE had Thrombolytics or Glycoprotein IIb/IIIa Inhibitors WITHIN PAST 48 HOURS				
aPTT (seconds)	Heparin Bolus (units)	Hold Infusion (Minutes)	**Rate Change (units/hr)** **** using 50 units/mL concentration****	Next aPTT (from the time rate was changed)
Less than 40	3,000	0	↑ 2.4 mL/120 units/ hr	4 hours later (STAT)
40-49	0	0	↑ 0.8 mL/40 units/ hr	6 hours later
50-70	0	0	0	Next AM
71-85	0	0	0	Next AM
86-100	0	30	↓ 2.4 mL/120 units/hr	6 hours after restarting
101-150	0	60	↓ 3.2 mL/160 units/hr	6 hours after restarting
Greater than 150		60	↓ 6.4 mL/320 units/hr	4 hours after restarting (STAT)
If aPTT is greater than 120 OR less than 50 x 2 consecutive blood samples, patch TMP				

***Contraindications to Heparin:**

- Active bleeding
- History of Heparin induced thrombocytopenia

Clinical Considerations/Notes:

- Consider Plavix, Ticagrelor
- Patch if PTT parameters (above) fall outside norm

Cardiogenic Pulmonary Edema

Indications:

- Initial MAP ≥ 70 mmHg and SBP > 100
  AND
- Heart Rate is ≥ 60 but < 160 bpm

Contraindications:

- Allergy or sensitivity to the medication
- No IV
- Nitroglycerin: Any phosphodiesterase-5 inhibitors use (Sildeafil [Viagra or Revatio], Tadalafil [Cialis], or Vardenafil [Levitra]) in the last 48 hours (these agents are commonly used for erectile dysfunction and are also used in pulmonary hypertension)

Treatment:

≥ ACP(f) / Initiate then Patch	**CPAP/NPPV**
	Initial Setting iPAP 10 cmH_2O/ePAP 5 cmH_2O MAX iPAP 20 cmH_2O/ePAP 10 cmH_2O

≥ PCP(f) / No Patch Required	**Nitroglycerin***
	0.4 mg SL spray q 5 minutes prn MAX of 6 doses

*Single PCP(f): Initiate then patch

ACP(L) / No Patch Required	**Nitroglycerin If SBP ≥ 140mmhg**
	0.8 mg SL spray q 5 minutes prn MAX of 6 doses *Patient requires IV or prior history of Nitroglycerin use

≥ ACP(f) / Mandatory Patch	**Nitroglycerin (Tridil)** **IV Infusion (for severe pulmonary edema)**
	Initiate 10 microgram/min IV titrate in 5 microgram/min increments q 5 minutes MAX 200 microgram/min

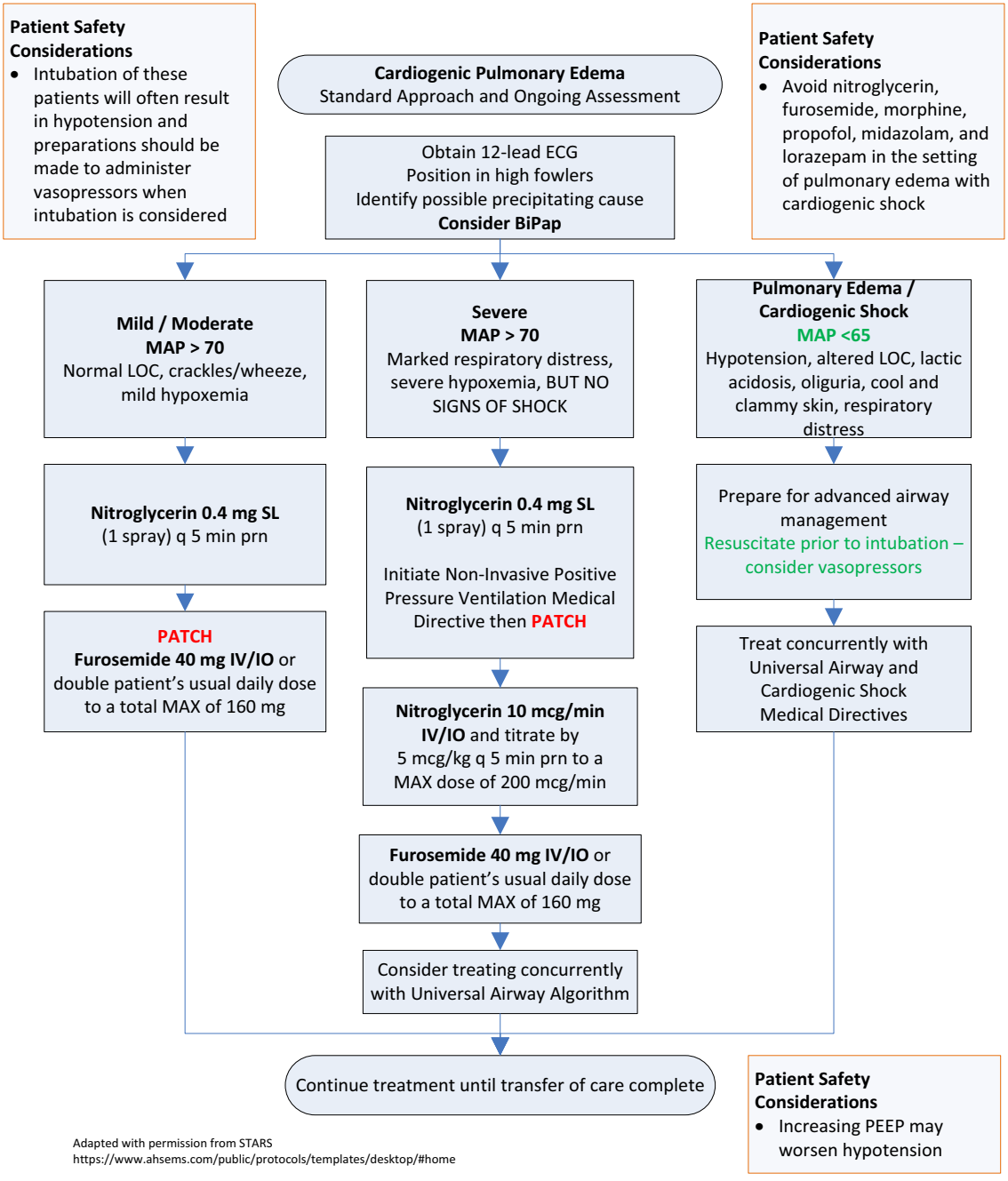
≥ ACP(f) / Mandatory Patch	**Furosemide (Lasix)**
	40 mg IV or double patients usual total daily dose MAX of 160 mg

Cardiogenic Pulmonary Edema (continued)

Clinical Considerations/Notes:

- If a patient presents with moderate to severe respiratory distress and the Paramedic suspects the patient is in acute pulmonary edema
- Reassess & document vitals between doses
- Discontinue Nitroglycerin if the BP or heart rate parameters for Nitroglycerin are no longer met
- Check blood pressure before administering each subsequent dose of Nitroglycerin

Cardiogenic Pulmonary Edema (continued)



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Ornge Clinical Practice Guideline: Cardiogenic Shock

Please refer to the *Drug Monographs and References* document for references listed in the CPGs

Suspect cardiogenic shock where there is acute severe LV or RV dysfunction with end-organ hypoperfusion (cool mottled extremities, decreased urine output, altered mentation). Acute LV failure may lead to acute pulmonary edema.

Most common cause is acute coronary syndrome but other causes include cardiomyopathies as well as valvular heart disease and tachyarrhythmias.

Severe shock is manifested by persistent hypotension: SBP<90 or MAP<60 or drop of MAP 30 mm Hg below baseline[1]

Rule out and treat correctable causes: ensure that myocardial dysfunction is not secondary to another cause such as severe sepsis or occult hemorrhagic shock or tachyarrhythmias.

ASA 160 mg is recommended to be given PO / NG / PR[2]

Vasoactive agents

- Vasopressor of choice is norepinephrine in severe shock with severe hypotension SBP <80 mmHg / MAP <60 mmHg
- DOBUTamine can be considered in cases where SBP >90 mmHg (MAP >65 mmHg) but should be used cautiously where BP is borderline

Avoid negative inotropes (beta blockers and calcium channel blockers) in patients with ACS and at risk for cardiogenic shock:

- SBP <120 mmHg
- Age over 70
- Heart rate >110 bpm
- Any sign of heart failure, acute pulmonary edema[3]

Avoid antiarrhythmic agents with negative inotropic or vasodilating properties such as lidocaine and procainamide. Amiodarone is preferred for sustained ventricular or atrial tachyarrhythmias[2]

Volume management

- Empiric challenge of 250 mL crystalloid IV if suspected cardiogenic shock with no signs of pulmonary congestion or signs of respiratory distress and no previous IV fluid boluses
- Caution in repeated fluid challenges to elderly, history of heart failure, large LV infarction
- In cases of right ventricular infarction with hypotension and clear lung fields, more volume resuscitation will be required.

Ventilatory support

- For respiratory failure from cardiogenic pulmonary edema
- To reverse severe acidemia in shock
- To relieve the work of breathing in refractory shock
- Airway protection and maintaining oxygenation where decreased level of consciousness

Mechanical support

- Intra-aortic balloon pump support can stabilize select patients in cardiogenic shock including the rapidly deteriorating patient with hypotension and/or cardiac arrhythmias or certain mechanical defects like acute mitral regurgitation or ventricular septal defect from wall rupture.
- Percutaneous left ventricular assist devices such as Impella can maintain cardiac outputs of 2.5-5.0 litres/ minute (depending on device) and can allow organ perfusion during myocardial stunning and while

awaiting cardiac recovery. Both these devices are wide bore catheters inserted into the femoral artery and come with a console which has to be transported with the patient.

Reperfusion

- Patients in cardiogenic shock should be rapidly transported to the closest center with PCI capabilities preferably with cardiac surgery backup.
- Fibrinolytic therapy should be considered where indicated provided no contraindication and PCI will be delayed more than 90 to 120 minutes. The decision should be made in conjunction with the receiving cardiologist. Benefit of fibrinolysis is questionable for delayed presentations of MI (>12-24 hours) but may be considered where there are signs of recent progression of infarct.

Cardiogenic Shock

Indications:

- Cardiogenic shock

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(L) / No patch required	**Normal Saline or Ringers Lactate**
	250 mL IV/IO bolus PRN, MAX 10 ml/kg Target MAP > 65

ACP(L) / Initiate then Patch	**DOPamine**
	5-20 mcg/kg/min Target MAP > 65 *ACP(L) only* ACP(f)/CCP should use Norepinephrine

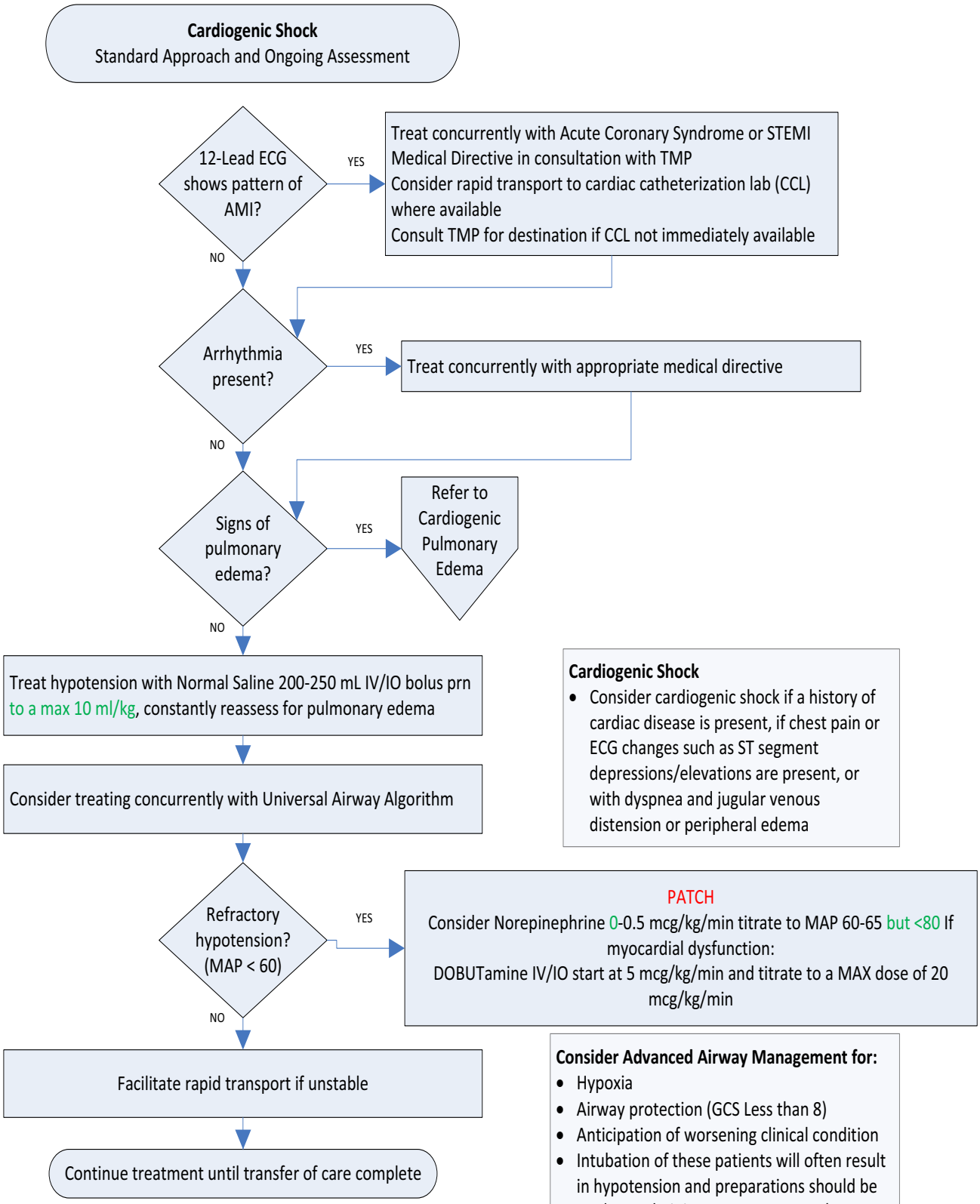
≥ ACP(f) / Initiate Then Patch	**Norepinephrine (Levophed)**
	0-0.5 microgram/kg/min IV/IO Target MAP > 65

CCP / Mandatory Patch	**DOBUTamine (Dobutrex)**
	5-20 microgram/kg/min IV/IO Initiate at 5 microgram/kg/min Minimum MAP 60 prior to initiating

Clinical Considerations/Notes:

- In general, titration of Norepinephrine should be based upon MAPs whereas response to DOBUTamine should be based on perfusion and clinical parameters such as urine output
- MAP parameters in cardiogenic shock should be targeted to low normal levels, MAP 60-65 and less than 80 provided there are signs of adequate perfusion

Cardiogenic Shock (continued)



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Intra-Aortic Balloon Pump (IABP) Auxiliary Medical Directive

Indications:

- A CCP may provide the treatment prescribed in this auxiliary medical directive if certified and authorized
- Patient > 18 years old
- Patient > 40 kg
- Patient must already be on Intra-Aortic Balloon Pump (IABP) at the sending hospital

Contraindications:

- Not applicable

Treatment:

- Paramedics are required to perform IABP specific assessments
  - Verify balloon position and size
  - Identify balloon tip on x-ray
  - Assess for distal pulses in insertion limb
  - Assess for urine output
  - Identify if catheter is fiber optic
  - Identify trigger being used
  - Assess IABP waveform
  - Ensure catheter is sutured securely in place

Paramedics are required to Patch to obtain orders when providing IABP care.

CCP / Mandatory Patch

Transition
• Both paramedics at the bedside for transition to transport IABP • Put IABP in 1:2 ratio • Select trigger • Assess and adjust 3 rules of timing to achieve ideal waveform and augmentation • Run a recording strip • Maintain head of bed no higher than 30 degrees • Keep insertion limb straight • Ensure no blood is present in the catheter • Return IABP ratio to 1:1 or 1:2 matching setting from sending
Transport
• Exercise caution to protect IABP catheter from being pulled. • Continuously monitor the patient and the performance of the IABP, make adjustments as required to maintain good augmentation • Run a recorder strip at the start of transport and again at the end of transport • Plug IABP into vehicle power source to conserve IABP internal battery
Transfer of Care
• Paramedics to ensure safe transfer of IABP care with accepting hospital staff • Run final strip prior to transfer • Document as required on ACR among other care the specifics of the IABP

Clinical Considerations/Notes:

- 1 IABP certified paramedic with CCP partner
- Paramedics are not permitted to advance or remove IABP catheters
- Paramedics are required to ensure transport IABP is in ready state, fully charged, appropriate helium levels, paper role, and appropriate cables
- Document sending facility IABP parameters

Extracorporeal Membrane Oxygenation (ECMO) Auxiliary Medical Directive

Indications:

- Veno-venous (VV) or Veno-arterial (VA) Extracorporeal Membrane Oxygenation (ECMO)/Extracorporeal Life Support (ECLS)
- Accompanied by ECMO team including ECMO physician
- A CCP may provide the treatment prescribed in this auxiliary medical directive if certified and authorized
- Age $\geq$ 16
- Successful cannula placement and ECMO initiation

Contraindications:

- Not applicable

Treatment:

CCP | No Patch Required

Mechanical ventilation*	
• Pressure Control Ventilation • RR 10 breaths/min** • Pressure control 10 cmH_20** • PEEP 10 cmH_20** • FiO2 0.3 • Protective lung strategy Vt 4-5 ml/kg IBW, RR 10/min, Ti 1.0 sec ** or to an initial maximum of 20-20-20 (RR-PC-PEEP) as requested by the ECMO physician	Keep plateau pressures less than 30 cm H_20 with adjustments unless ECMO failure (see ECMO failure emergency medical directives) May titrate FiO_2 up to 1.0 and PEEP up to 20 if requested by ECMO physician Given that $PaCO_2$ and PaO_2 determined by ECMO rather than mechanical ventilation, there is no need to titrate mechanical ventilation during transport (please refer to the Emergency Medical Directive for ECMO/ECLS Failure portion at the end of the Medical Directive for orders in the event of ECMO failure)

*Confirm ETT placement on chest X-ray from sending facility

Circulation and Fluids

Continue any of the following medications being administered at the time of initiation of ECMO and/or add/titrate at the request of the ECMO physician within the prescribed ranges below. Match dose from sending facility as starting dose.

CCP | No Patch Required

Norepinephrine (Levophed)
0-0.5 microgram/kg/min IV Match sending facility for starting dose Target MAP > 65

CCP | No Patch Required

Vasopressin
0.02-0.1 units/min IV Match sending facility for starting dose Target MAP > 65

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CCP	No Patch Required	**EPINEPHrine** Target MAP > 65		
		Bolus	and/or	Maintenance Infusion
		5-20 mcg * q 3 minutes prn IV		0-0.5 microgram/kg/min Match sending facility for starting dose

*to prepare push-dose EPINEPHrine (i.e., 10 microgram/mL concentration)

1. Draw 100 microgram (i.e. 1 mL of 1:10,000) EPINEPHrine and dilute in 9 mL of Normal Saline

CCP	No Patch Required	**Phenylephrine** Target MAP >65		
		Bolus	and/or	Maintenance Infusion
		100-200 micrograms q 3 minutes prn IV		0-500 microgram/min Match sending facility for starting dose

CCP	No Patch Required	**Fluids**		
		Bolus	and/or	Maintenance Infusion
		Bolus 20 mL/kg RL or NS q 15 minutes prn to keep MAP > 65 and/or if rising vasopressor requirements Assess for signs of fluid overload between each bolus and hold further fluid boluses if signs fluid overload May substitute sodium bicarbonate (3 amps in 850 cc D5W) instead of NS/RL as bolus fluid 20 ml/kg at request of ECMO physician for metabolic acidosis		Maintenance infusion RL or NS at 0-150 cc/hr (choice as per ECMO physician and/or to match sending facility, RL preferred) May switch to sodium bicarbonate infusion (3 amps in 850 mL D5W) at 0-150 cc/hr

CCP	No Patch Required	**Packed Red Blood Cells (PRBC)**
		Transfuse PRBC at request of ECMO physician if Hb < 70 g/L or if active bleeding; medics may bring PRBC from sending facility to have on standby if available and requested by ECMO physician

Extracorporeal Membrane Oxygenation (ECMO) Auxiliary Medical Directive (continued)

For Sedation

CCP	No Patch Required	fentaNYL (Sublimaze)		
		Bolus	and/or	Maintenance Infusion
		50-100 micrograms IV q 10 minutes prn		0-500 microgram/hr IV Target MAP > 65

AND

CCP	No Patch Required	Propofol (Diprivan)
		0-5 mg/kg/hr Target MAP > 65

OR

CCP	No Patch Required	Midazolam (Versed)		
		Bolus	and/or	Maintenance Infusion
		2-4 mg IV q 10 minutes prn		0-0.25 mg/kg/hr IV Target MAP > 65

OR

CCP	No Patch Required	Ketamine		
		Bolus	and/or	Maintenance Infusion
		10-20 mg IV q 5 minutes prn		0-4.5 mg/kg/hr IV Target MAP > 50

For Paralysis*

CCP	No Patch Required	Cisatracurium		
		Bolus	and/or	Maintenance Infusion
		0.1-0.2 mg/kg IV to initiate paralysis 0.03 mg/kg IV q 30 minutes prn		1-10 microgram/kg/min (usual starting dose 3 microgram/kg/min after initiating paralysis)

OR

CCP	No Patch Required	Rocuronium (Zemuron)		
		Bolus	and/or	Maintenance Infusion
		0.6 mg/kg IV to initiate paralysis 0.3 mg/kg IV q 20 minutes		10-15 microgram/kg/min to maintain paralysis

*Must have analgesia (fentaNYL) plus sedation (propofol, midazolam or ketamine) running at all times while paralyzed

Extracorporeal Membrane Oxygenation (ECMO) Auxiliary Medical Directive (continued)

Additional Medications

At request of ECMO physician

CCP	No Patch Required	**Unfractionated Heparin**		
		Bolus	and/or	Maintenance Infusion
		May give 5000 units IV bolus upon cannulation; repeat as requested by ECMO physician/perfusionist		0-3000 units/hr IV, continue dose from sending; adjust as requested by ECMO physician based on PTT/ACT as directed by ECMO physician/perfusionist (target ACT 160-180 sec)

CCP	No Patch Required	**Furosemide (Lasix)**		
		Bolus	and/or	Maintenance Infusion
		20-160 mg IV x 1 prn		0-20 mg/hr IV

CCP	No Patch Required	**Tranexamic Acid (TXA)**
		1 g IV bolus for bleeding

CCP	No Patch Required	**Pantoloc (Pantoprazole)**		
		Bolus	and/or	Maintenance Infusion
		40-80 mg bolus IV		8 mg/hr IV infusion

Clinical Considerations/Notes:

- The CCP must patch with the TMP if medications are required beyond those provided for in these Medical Directives; if medication doses are required beyond those provided for in these medical directives; or in the case of ECMO failure requiring use of emergency medical directives (as soon as practical and safe to do so taking into account workload to stabilize patient)
- The CCP may also provide all additional care covered by routine CCP level medical directives

Emergency Medical Directive for ECMO/ECLS Failure

Defined as:

- Cardiac Arrest
- ECMO/ECLS equipment failure
- Failure to Oxygenate
- Uncontrolled bleeding/Volume loss/Exsanguination

May use all above ECMO medical directives, standard CCP Medical Directives, **and in addition**:

		Mechanical ventilation
CCP	Initiate then Patch*	• FiO_2 1.0 and titrate down for O_2 saturation > 95% • PEEP 5-20, may increase settings to aim for Vt 6-8 ml/kg • PIP < 30 (may increase to 40 if unable to achieve targets with settings otherwise) • Titrate RR to achieve EtCO2 50-60 target • I:E 1:1 if possible for oxygenation failure

*Mandatory TMP patch if ECMO failure as soon as possible after initiation of ECMO failure orders taking into account immediate patient care needs

		ECMO Failure
CCP	Mandatory Patch	• Cardiac arrest • ECMO/ECLS equipment failure • Failure to oxygenate • Uncontrolled bleeding/volume loss/exsanguination

Arrhythmias

Adult Symptomatic Bradycardia

Indications:

- Symptomatic Bradycardia with a pulse

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(L) / Initiate Then Patch	**Atropine**
	0.5 mg IV/IO initial dose (repeat q 3-5 minutes to max total dose 3 mg)

≥ ACP(L) / Initiate then Patch	**DOPamine**
	5-20 microgram/kg/min IV Target MAP > 65 HR >50

Patients with bradycardia requiring transcutaneous pacing (TCP) who are conscious and aware of their surroundings may require sedation and analgesia prior to TC pacing. Below are directives for sedation and analgesia for TCP . Patients that are peri-arrest can immediately receive TCP without sedation or analgesia.

≥ ACP(L) / Initiate then Patch	**Transcutaneous Pacing**
	Set pacing rate at 70 Start output at 10 milliamps (mA) and increase to achieve electrical capture with a pulse (mechanical capture) Once mechanical capture has been confirmed increase mA by 10% Confirm the presence of a pulse and assess blood pressure and perfusion

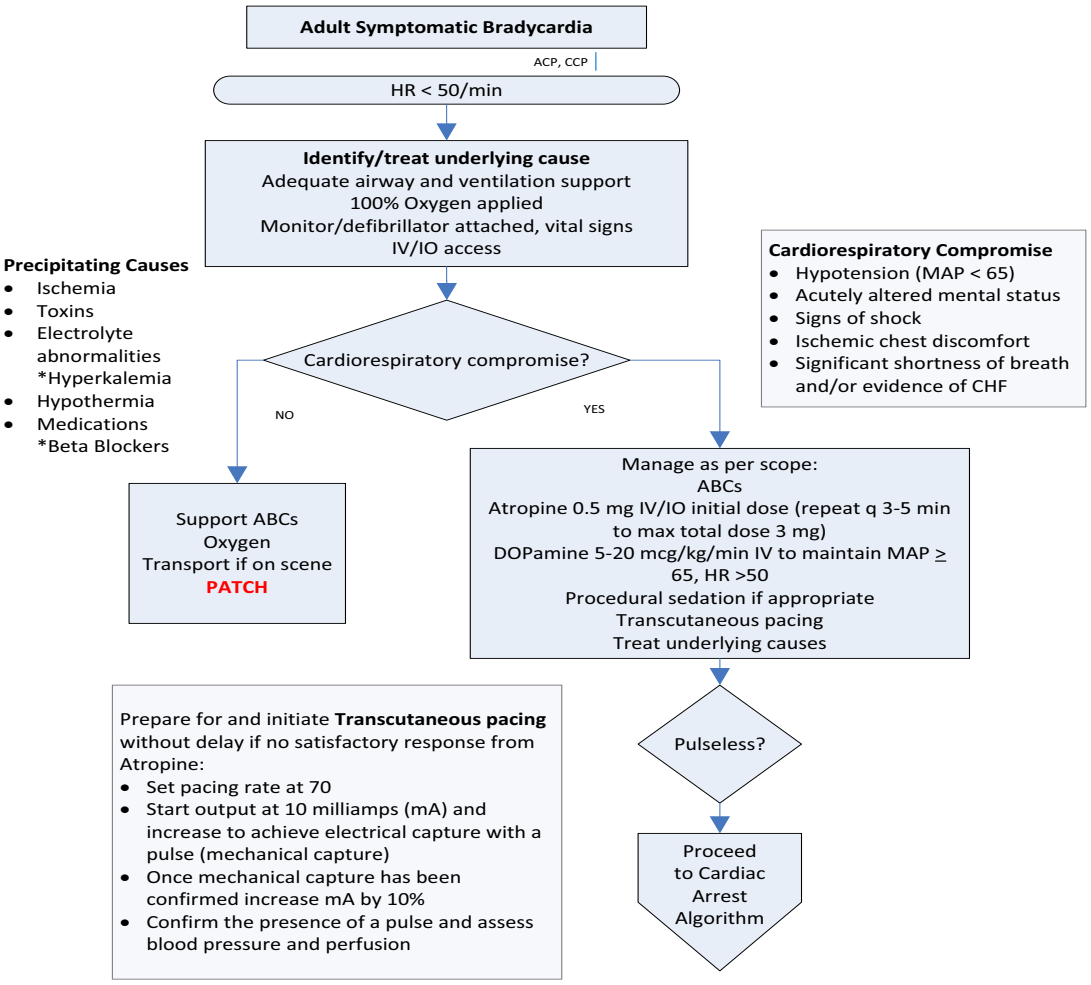
ACP(L) / Mandatory Patch	**Procedural Sedation**
	Versed 0.05 mg/kg and/or fentaNYL 1 microgram/kg

≥ ACP(f) / Mandatory Patch	**Procedural Sedation**	
	MAP > 65 Ketamine 0.1 mg/kg, MAX 0.5 mg/kg **OR** Versed 0.05 mg/kg and/or fentaNYL 1 microgram/kg	**MAP < 65** Ketamine 0.1 mg/kg, MAX 0.5 mg/kg

Adult Symptomatic Bradycardia (continued)

CCP	Initiate Then Patch	Procedural Sedation	
		MAP > 65 Ketamine 0.1 mg/kg, MAX 0.5 mg/kg **OR** Versed 0.05 mg/kg and/or fentaNYL 1 microgram/kg	**MAP < 65** Ketamine 0.1mg/kg, MAX 0.5 mg/kg

Adult Symptomatic Bradycardia (continued)



Transvenous Cardiac Pacing

Indications:

- Transvenous pacing, if initiated at the sending facility

Contraindications:

- Not applicable

Treatment:

≥ CCP	Initiate Then Patch	**Maintain transvenous pacing if initiated at sending facility (Initial pacing settings will reflect sending facility settings)**
	Mandatory Patch	**Any alteration of settings to be discussed with TMP**

Clinical Considerations/Notes:

- Monitor the cardiac rhythm and ensure the catheter/cable is carefully secured to prevent inadvertent tension or traction on the line
- Ideal capture threshold is ≤ 1. High outputs are an indication of misplaced wires or more serious pathology that can be more prone to capture failure and need for TCP vs other interventions

Adult Symptomatic Atrial Fibrillation/Flutter

Indications:

- Symptomatic Atrial Flutter
- Symptomatic Atrial Fibrillation

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

Patients with Atrial Fibrillation/Flutter where emergency synchronized cardioversion is indicated who are conscious and aware of their surroundings may require sedation and analgesia first. Below are medical directives for sedation and analgesia for cardioversion. Patients that are peri-arrest or hemodynamically unstable can be immediately managed with synchronized cardioversion without sedation or analgesia

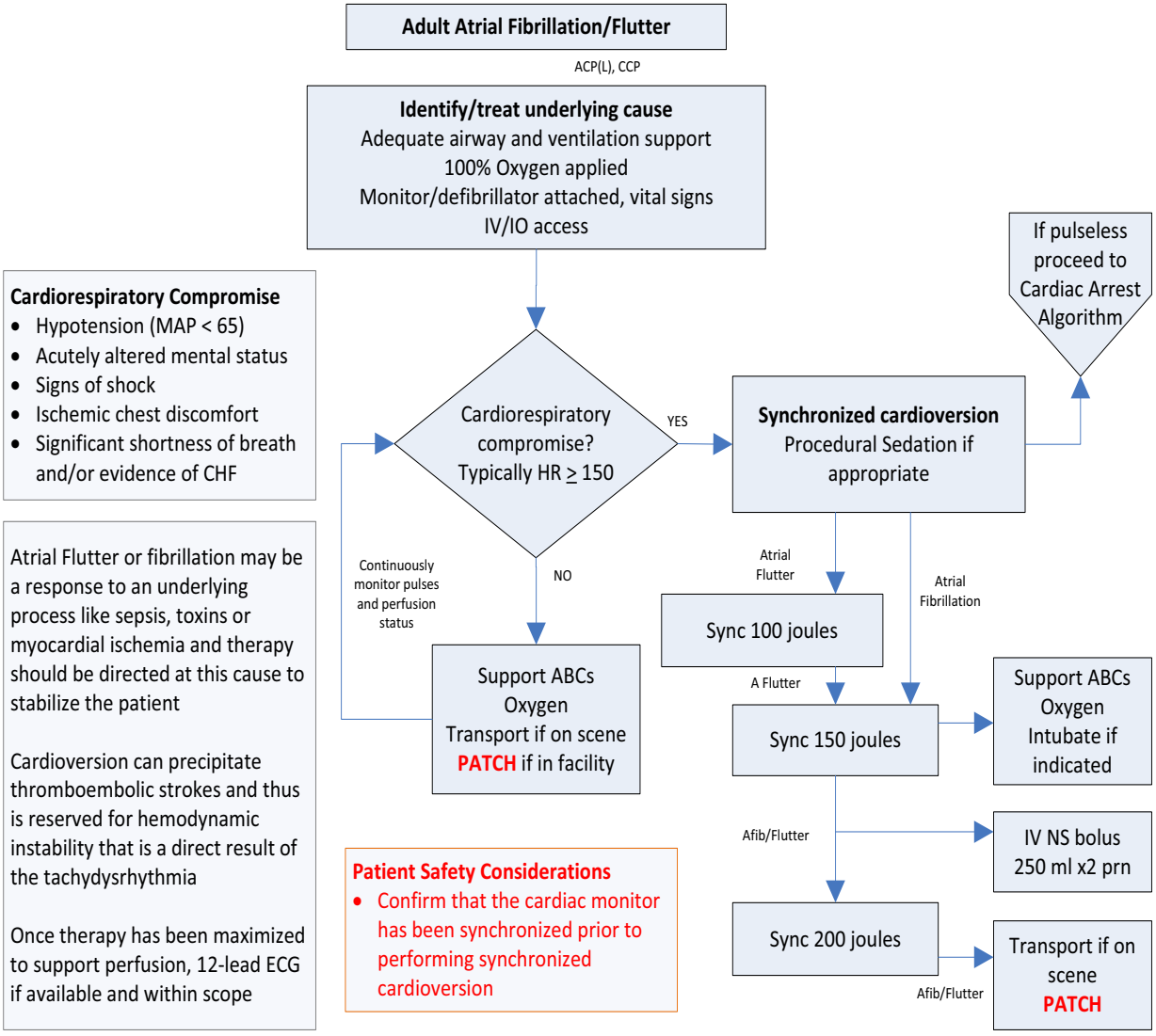
≥ ACP(L) / Initiate Then Patch	**Synchronized Cardioversion**

ACP(L) / Mandatory Patch	**Procedural Sedation**
	Versed 0.05 mg/kg and/or fentaNYL 1 microgram/kg

≥ ACP(f) / Mandatory Patch	**Procedural Sedation**	
	MAP > 65 Ketamine 0.1 mg/kg, MAX 0.5 mg/kg **OR** Versed 0.05 mg/kg and/or fentaNYL 1 microgram/kg	**MAP < 65** Ketamine 0.1 mg/kg, MAX 0.5 mg/kg

CCP / Initiate Then Patch	**Procedural Sedation**	
	MAP > 65 Ketamine 0.1 mg/kg, MAX 0.5 mg/kg **OR** Versed 0.05 mg/kg and/or fentaNYL 1 microgram/kg	**MAP < 65** Ketamine 0.1mg/kg, MAX 0.5 mg/kg

Adult Symptomatic Atrial Fibrillation/Flutter (continued)



Adult Paroxysmal Supraventricular Tachycardia (PSVT)

Indications:

- Paroxysmal Supraventricular Tachycardia (PSVT)

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

Patients with PSVT with a pulse who are conscious and aware of their surroundings may require sedation and analgesia prior to cardioversion. Below are directives for sedation and analgesia for cardioversion. Patients that are peri-arrest or hemodynamically unstable can be immediately cardioverted with synchronized cardioversion (without sedation or analgesia).

≥ ACP(L) Initiate Then Patch	**Synchronized Cardioversion**

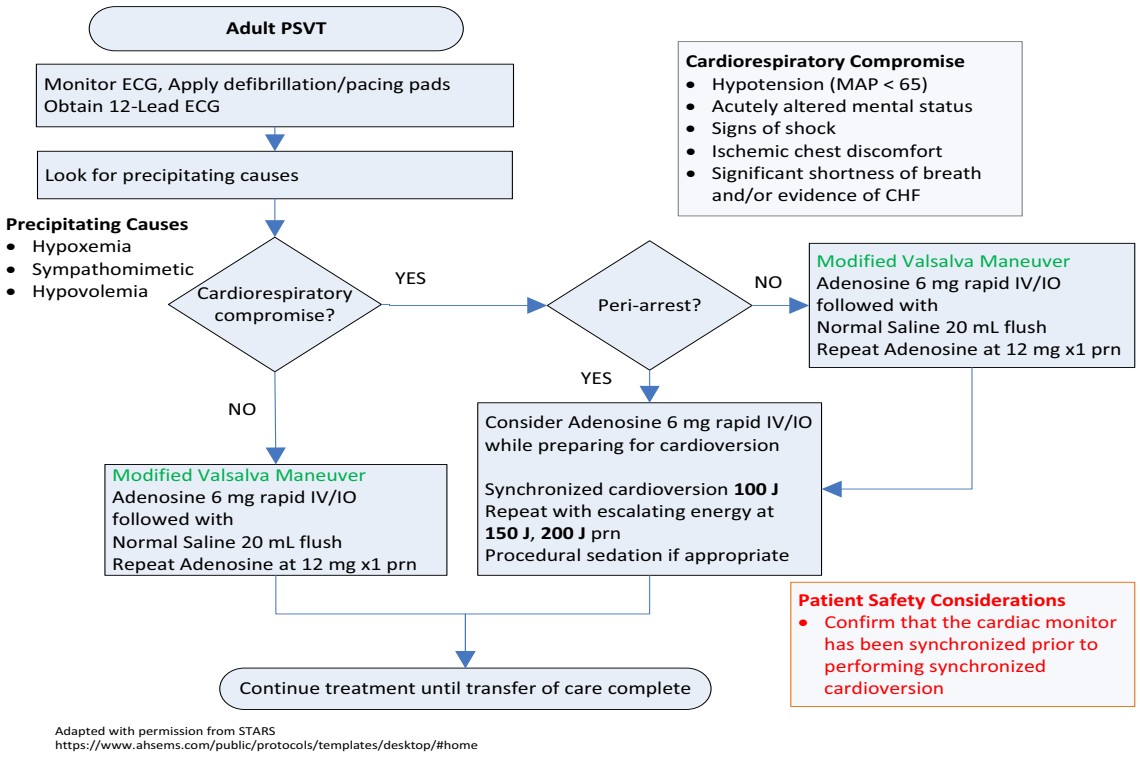
ACP(L) Mandatory Patch	**Procedural Sedation**
	Versed 0.05 mg/kg and/or fentaNYL 1 microgram/kg

≥ ACP(f) Mandatory Patch	**Procedural Sedation**	
	MAP > 65 Ketamine 0.1 mg/kg, MAX 0.5 mg/kg **OR** Versed 0.05 mg/kg and/or fentaNYL 1 microgram/kg	**MAP < 65** Ketamine 0.1 mg/kg, MAX 0.5 mg/kg

CCP Initiate Then Patch	**Procedural Sedation**	
	MAP > 65 Ketamine 0.1 mg/kg, MAX 0.5 mg/kg **OR** Versed 0.05 mg/kg and/or fentaNYL 1 microgram/kg	**MAP < 65** Ketamine 0.1mg/kg, MAX 0.5 mg/kg

≥ ACP(L) Initiate then Patch	**Adenosine**
	6 mg rapid IV/IO with 20 mL NS flush Repeat at 12 mg x 1 prn

Adult Paroxysmal Supraventricular Tachycardia (PSVT) (continued)



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Clinical Considerations/Notes:

- Adenosine dose should be decreased if patient taking dipyridamole or carbamazepine, dose should be decreased if given by central line; caution in asthma

Adult Ventricular Tachycardia with Perfusion

Indications:

- Ventricular Tachycardia (VT) with a pulse

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

Patients with VT with a pulse who are conscious and aware of their surroundings may require sedation and analgesia prior to cardioversion. Below are directives for sedation and analgesia for cardioversion. Patients that are peri-arrest or hemodynamically unstable can be immediately cardioverted with synchronized cardioversion without sedation or analgesia.

≥ ACP(L) / Initiate Then Patch	**Synchronized Cardioversion**

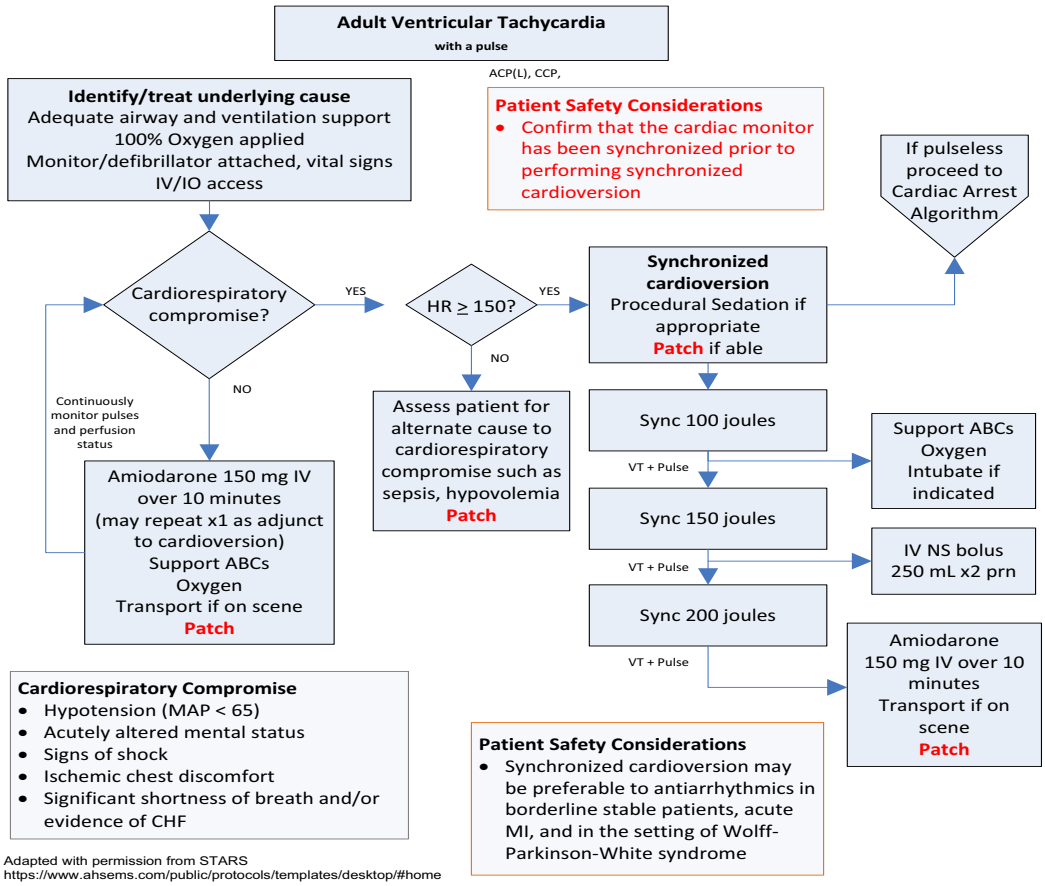
ACP(L) / Mandatory Patch	**Procedural Sedation**
	Versed 0.05 mg/kg and/or fentaNYL 1 microgram/kg

≥ ACP(f) / Mandatory Patch	**Procedural Sedation**	
	MAP > 65 Ketamine 0.1 mg/kg, MAX 0.5 mg/kg **OR** Versed 0.05 mg/kg and/or fentaNYL 1 microgram/kg	**MAP < 65** Ketamine 0.1 mg/kg, MAX 0.5 mg/kg

CCP / Initiate Then Patch	**Procedural Sedation**	
	MAP > 65 Ketamine 0.1 mg/kg, MAX 0.5 mg/kg **OR** Versed 0.05 mg/kg and/or fentaNYL 1 microgram/kg	**MAP < 65** Ketamine 0.1mg/kg, MAX 0.5 mg/kg

≥ ACP(L)* / No patch required	**Amiodarone (Cordarone)**
	150 mg IV over 10 minutes (may repeat x1 as adjunct to cardioversion)

Adult Ventricular Tachycardia with Perfusion (continued)



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Clinical Considerations/Notes:

- Consider early Magnesium IV for polymorphic VT
- Polymorphic VT should prompt consideration if clinically appropriate for toxicologic exposure which have specific antidote therapies (Ex: Beta blockers in hydrocarbon toxicity). Emergent TMP consultation is indicated
- Consider hyperkalemia medical directive (**172**) for wide complex tachycardia/lethal arrythmias

IV/IO and Arterial Lines

Intravenous Line Initiation

Indications:

- Actual or potential need for intravenous or fluid therapy

Contraindications:

- Suspected fracture proximal to the IV site

Treatment:

		Initiate IV
≥ ACP(L)*	No Patch Required	MAX of 2 peripheral IV lines may be established

Clinical Considerations/Notes:

- *A PCP(f) may provide the treatment prescribed in this auxiliary medical directive if certified and authorized

Intraosseous Initiation and Maintenance

Indications:

- Inadequate intravenous access for **resuscitation**
- Unable to obtain intravenous access after two (2) attempts or 90 seconds

Contraindications:

- Known or suspected fracture, injury, deformity, or infection overlying the proposed insertion site
- Absence of adequate anatomic landmarks
- Previous IO insertion in the bone in the past 48 hours
- Known or suspected fracture of affected limb

Treatment:

≥ ACP(L)	Initiate Then Patch	**Initiate the appropriate intervention based upon the presenting condition**

Clinical Considerations/Notes:

- Resuscitation indicates the process of correcting physiological disorders in the acutely unwell patient. The patient need not be in cardiac arrest to qualify for IO insertion

Intraosseous Vascular Access Analgesia

Indications:

- Patient requiring intraosseous (IO) needle access and responsive to pain

Contraindications:

- Sino-atrial disorders
- All grades of AV block, Stokes-Adams syndrome, Wolff-Parkinson-White syndrome
- Acute porphyria
- Hypersensitivity to another local anesthetic of the amide type

Treatment:

≥ ACP(L) Initiate then Patch

	Lidocaine 2% without epinephrine	
	1st Dose	**2nd Dose**
40 - 60 kg	30 mg (1.5 mL)	15 mg (0.75 mL)
61-70 kg	35 mg (1.75 mL)	17.5 mg (0.9 mL)
71 kg +	40 mg (2 mL)	20 mg (1 mL)

*Administer **first dose** over 2 minutes then allow lidocaine to dwell for 1 minute in IO space and flush with 5-10 mL 0.9% saline
Followed by **second dose** of lidocaine over 1 minute

Clinical Considerations/Notes:

- After the second lidocaine dose is given, medication or fluids may be administered under pressure as required
- Can consider administering again in 45 minutes later at the lower of the two previous doses given if discomfort re-occurs
- If extravasation occurs insert a new IO needle
- Cimetidine or beta-blockers (e.g. propranolol) may interact and cause lidocaine toxicity

Intravenous Line Maintenance Standard: PCP(f)

Indications:

- Initiated by sending facility

Contraindications:

- Not applicable

Treatment:

PCP(f)	No Patch Required	**Maintain IV**
		May transport a patient with a saline IV infusion containing thiamine, multivitamin preparations and KCl to a MAX **of 40 mEq**/Litre as initiated by the sending hospital and maintain at the rate set by the sending facility up to a MAX of 200 mL/hr

Clinical Considerations/Notes:

- To keep the vein open (TKVO)
  - The minimum flow rate to maintain IV patency for a patient ≥12 years of age is 30 mL/hr of any isotonic fluid (Normal saline or ringers lactate); or
- For fluid replacement
  - A maximum flow rate infused of up to 2 mL/kg/hr to a MAX of 200 mL/hr,
  - Thiamine, multivitamin preparations,
  - Drugs within his/her level of certification, or
  - Potassium chloride (KCl) for patients ≥18 years of age, to a MAX of 10 mEq in a 250 mL or 40 mEq in a 1000 mL bag

Blood Sampling and Lab Value Interpretation

Indications:

- To establish baseline respiratory, cardiovascular, hematological status prior to or during transport
- To monitor changes and/or deterioration in clinical status

Contraindications:

- Not applicable

Treatment:

≥ ACP(f)	Initiate then Patch	**Perform venipuncture, venous blood sampling and utilize iSTAT if available** **Perform arterial blood sampling and utilize iSTAT if available**

Clinical Considerations/Notes:

- Management based on these results will be via patch with the TMP
- These tests should only be completed if absolutely essential to patient management en route and will not cause unnecessary delays in transport

Maintaining and Accessing Central Venous Lines

Indications:

- Actual or potential need for intravenous medication / fluid therapy
  AND
- Central venous access is available

You may access the following types of devices:

- Hickman
- PICC (Peripherally Inserted Central Catheter)
- Central Venous Line

Contraindications:

- Not applicable

Treatment:

PCP(f)	No Patch Required	**<u>Must be capped for transport</u>** Devices **<u>must not</u>** be accessed by the PCP(f)
≥ ACP(L)	No Patch Required	**Access established CVAD for utilization**

Clinical Considerations/Notes:

- Every lumen of a capped central line must be flushed prior to transport to ensure that they are patent and functional as per the Ornge Medical Procedure Manual
- Venous devices that are located subcutaneously, i.e. PortaCath or similar devices MAY NOT to be accessed
- Dialysis catheters will not be accessed without a TMP patch

Arterial Line Maintenance and Monitoring

Indications:

- Established arterial line

Contraindications:

- Not applicable

Treatment:

≥ ACP(f)	Initiate then Patch	**Perform blood sampling and utilize iSTAT if available**

≥ ACP(f)	No Patch Required	**Monitor and transduce an established arterial line**

Clinical Considerations/Notes:

- NS is the preferred solution for arterial lines with flush / pressure bag / transducer system unless sending facility has it heparinized in which case, one should continue as per sending
- Arterial lines are not to be capped or locked due to the risk of thrombosis. Instead, it must be removed if not transduced
- Arterial lines are calibrated (zeroed) with any changes in level of bed &/or position of head of bed to transducer, if waveform changes and with IV tubing changes
- Ensure all connections are tight , line is secured (ie arm board) and limb properly restrained as required
- Blood backing up the transducer tubing from the patient may indicate a leak, crack or loose connections

Pulmonary Artery Catheters Auxiliary Medical Directive

Indications:

- A CCP may provide the treatment prescribed in this auxiliary medical directive if certified and authorized

Contraindications:

- Not applicable

Treatment:

CCP	Mandatory Patch	
		Transport and monitor PA Catheters

Clinical Considerations/Notes:

- If the arterial line and PA catheter cannot be simultaneously monitored then the arterial line will be monitored and the PA line will be removed. Authorized CCPs may remove the PA catheters prior to transport if required. The catheter must be completely removed, not just pulled back into the right atrium or SVC. The introducer (cordis) should be left in-situ and a plug inserted so that a new PA line may be inserted at the receiving facility
- If the patient must be transported with a PA catheter in place, and no authorized CCP is available, the sending facility must send an appropriate escort with the responsibility for care and monitoring of the PA catheter under the sending facility staff

Neurological

Ischemic Stroke

Acute blood pressure management

a. The ideal level of blood pressure to target in the hyperacute phase is unknown at this time
b. Ischemic stroke patients eligible for thrombolytic therapy: reduce blood pressure to a target of below 180/105 mmHg)
c. Ischemic stroke patients not eligible for thrombolytic therapy: Treatment of hypertension in the setting of acute ischemic stroke should not be routinely undertaken
d. Extreme blood pressure elevation (i.e. systolic greater than 220 or diastolic greater than 120 mmHg) should be treated to reduce the blood pressure by approximately 15%, and not more than 25%, over the first 24 h, with further gradual reduction thereafter to targets for long-term secondary stroke prevention

Blood glucose abnormalities

a. All patients with suspected acute stroke should have their blood glucose concentration checked
b. Hypoglycemia should be corrected immediately

Additional management

a. Supplemental oxygen should be provided for patients with oxygen saturation below 94%. Supplemental oxygen is not required for patients with normal oxygen saturation levels (94% or above)
b. Temperature should be routinely monitored and treated if above 37.5°C

Acute Ischemic Stroke Therapy (Acute ischemic stroke therapy best practice recommendations 2015)

Patient selection

a. Symptoms of disabling stroke - intravenous tPA (within 4.5 h from stroke symptom onset) and interventional treatment with endovascular therapy (within a six-hour window from stroke symptom onset)

Intravenous thrombolysis

a. Administration of tPA 0.9 mg/kg to a maximum of 90 mg total dose, with 10% (0·09 mg/kg) given as an intravenous bolus over one-minute and the remaining 90% (0·81 mg/kg) given as an intravenous infusion over 60 minutes
b. Management of complications from tPA administration:
    i There is insufficient evidence to support the routine use of fresh frozen plasma, prothrombin complex concentrates, or platelet transfusions for tPA-associated bleeding

Endovascular therapy

a. Endovascular therapy is indicated in patients who have received intravenous tPA and those who are not eligible for intravenous tPA, or those select patients within 6-12 hours of presentation. Patients eligible for intravenous tPA as well as endovascular therapy should also be treated with intravenous tPA, which can be initiated while simultaneously preparing the angiography suite for endovascular therapy

Acute Aspirin Therapy (Acute aspirin therapy best practice recommendations 2015)

a. All acute stroke patients not already on an antiplatelet agent and not receiving tPA therapy should be given at least 160 mg of acetylsalicylic acid (ASA) immediately as a one-time loading dose after brain imaging has excluded intracranial hemorrhage and after dysphagia screening has been performed and passed
b. In patients treated with tPA, acetylsalicylic acid (ASA) should be delayed until after the 24-hour post-thrombolysis scan has excluded intracranial hemorrhage
c. In dysphagic patients, ASA may be given by enteral tube (80 mg daily) or by rectal suppository (325 mg daily)

d. In pediatric patients, initial treatment with anticoagulation (heparin) or aspirin at established pediatric dosing should be considered and continued until cervical artery dissection and intracardiac thrombus is excluded. If neither is present, switch to acute aspirin therapy at dose of 1–5 mg/kg 1
e. In patients already on ASA prior to ischemic stroke or transient ischemic attack, clopidogrel may be considered as an alternative. If rapid action is required, then a loading dose of 300 mg of clopidogrel could be considered, followed by a maintenance dose of 75 mg once a day

Acute Intracerebral Hemorrhage (Acute ICH best practice recommendations 2015)

Blood pressure management

a. There is presently insufficient evidence to demonstrate that lower blood pressure targets are associated with better clinical outcomes, and research is ongoing in this area. American heart Association guidelines suggest that for patients presenting with SBP 150-220 mmHg that lowering blood pressure to a target SBP of 140 mmHg is safe.
b. *Labetalol* is recommended as a first-line treatment for acute blood pressure management if there are no contraindications

Blood glucose abnormalities:

a. All patients with suspected acute stroke should have their blood glucose concentration checked
b. Hypoglycemia should be corrected immediately

Additional management

a. Supplemental oxygen should be provided for patients with oxygen saturation below 94%. Supplemental oxygen is not required for patients with normal oxygen saturation levels (94% or above)
b. Temperature should be routinely monitored and treated if above 37.5°C

Management of anticoagulation

a. Patients on warfarin - PCC is preferred because the onset of action is fast, but fresh-frozen plasma and vitamin K could be used as alternative if PCC is not available
b. Antiplatelet agents (i.e. ASA, clopidogrel, dipyridamole/ASA) should be stopped immediately in patients who are routinely on these agents
c. Anticoagulation Reversal NOAC
    i Dabigatran only: Idarucizumab
        - 5 grams (2 x 2.5 vials) in 100 mL over 10 minutes by bolus infusion
        - Compatible with NS
        - Risk: anaphylaxis
    ii Rivaroxaban/apixaban
        - aPCC/PCC-recommended by expert opinion and in vitro/rats[2, 3, 4]
        - PCC 2000 IU flat dose (no evidence to support one dose over another)
        - Repeat at 1 hour if ongoing bleeding
        - Unknown if you can use the INR to determine if there is unbound drug left after reversal
        - Antidotes in development

Stroke

Indications:

- Acute stroke

Contraindications:

- Allergy or sensitivity to the medication
- Traumatic head injury
- Blood glucose < 4 mmol

Treatment:

≥ ACP(f) | Mandatory Patch

Labetalol Hold if HR < 60 bpm MAX dose 300 mg/day	
10-20 mg slow IV push q 20 minutes prn until desired MAP achieved	Infusion 0.5-2 mg/min

≥ ACP(f) | Mandatory Patch

Hypertonic Saline (3%)
3 mL/kg IV/IO MAX rate of 20 mL/min Consider if MAP < 80 mmHg

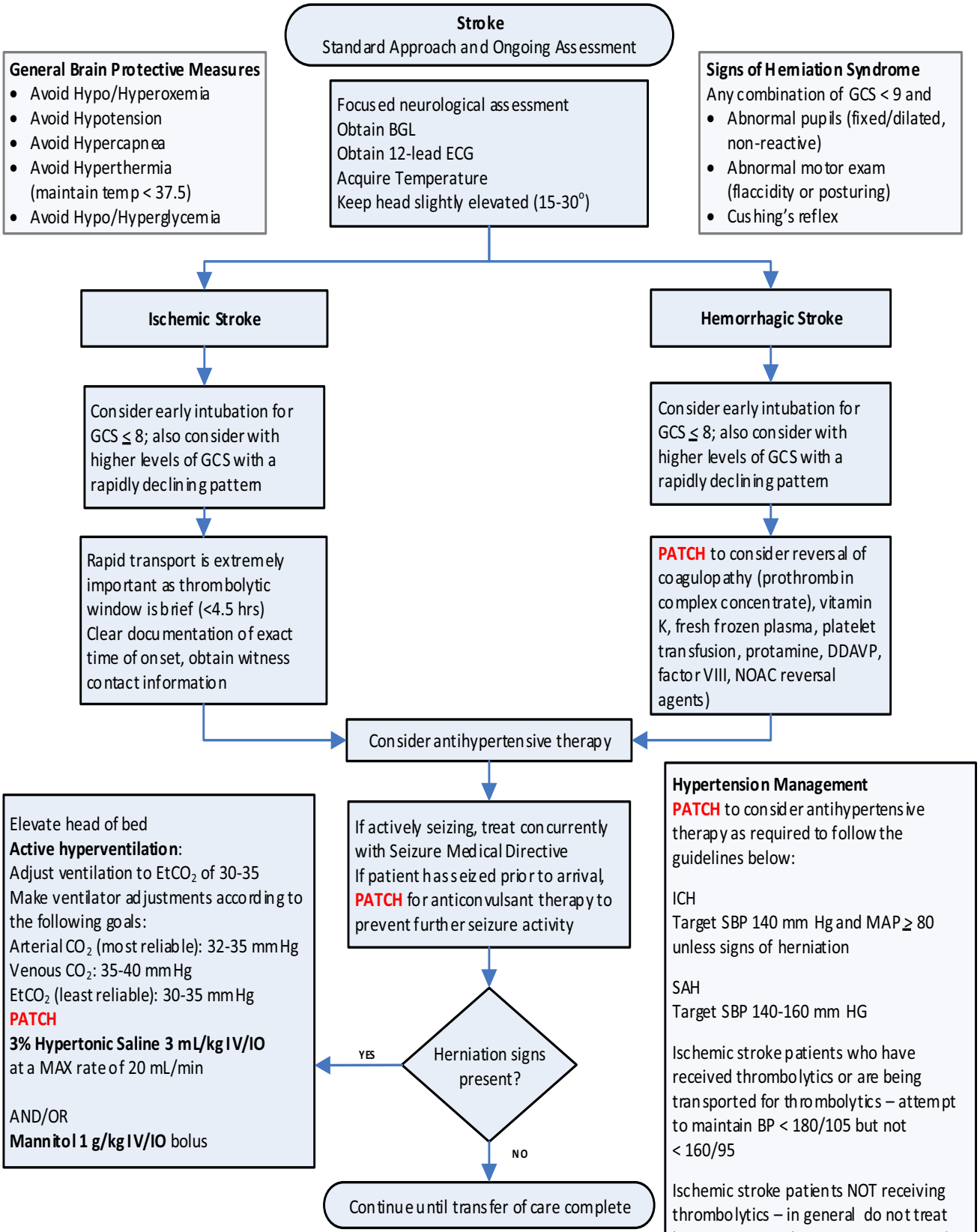
≥ ACP(f) | Mandatory Patch

Mannitol
1 g/kg IV/IO bolus MAP >80 mmHg

Clinical Considerations/Notes:

- Not applicable

Stroke (continued)



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Seizures - Adult

Indications:

- Active Seizure

Contraindications:

- Allergy or sensitivity to the medication
- If blood glucose level ≤ 4 mmol/L, proceed with protocol for “Hypoglycemic Emergencies”.

Treatment:

If, on assessment, a patient is determined to be having a seizure, management of airway, breathing and circulation remain the first priority: adequate oxygenation and ventilation must be ensured.

≥ ACP(L) / Initiate Then Patch	**Midazolam (Versed) for Seizures**
	5 mg IV/IO doses repeated every 5 minutes, until seizure termination or MAX dose of 0.2 mg/kg IV/IO in total **OR** 10 mg IM if no IV/IO access

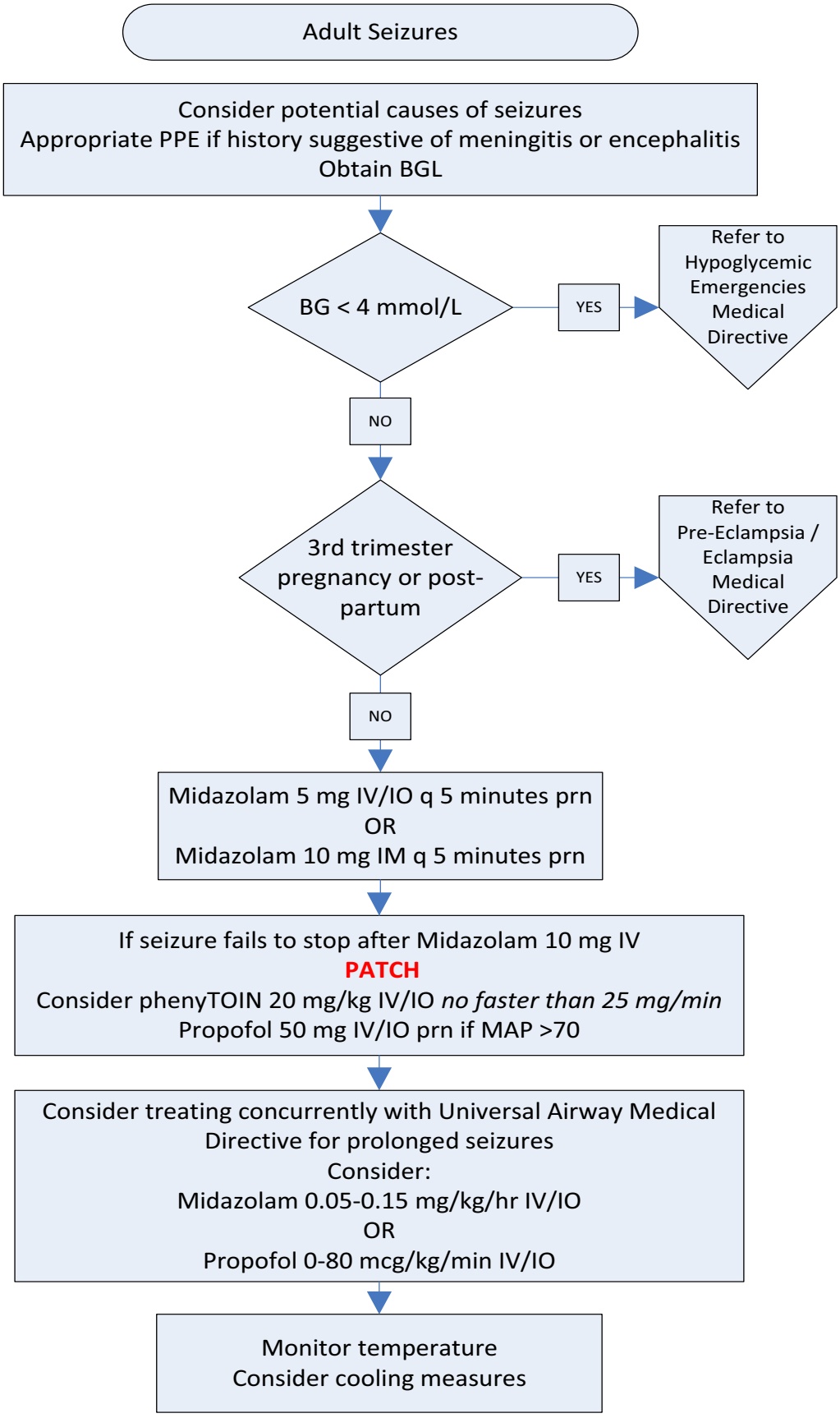
≥ ACP(f) / Mandatory Patch	**phenyTOIN (Dilantin)**
	20 mg/kg add to 250 mL NS IV/IO Infusion should be no faster than 25 mg/min **USE NORMAL SALINE ONLY** phenyTOIN will precipitate in dextrose solutions

≥ CCP / Mandatory Patch	**Propofol**
	50 mg IV/IO q 5 minutes prn if MAP > 70 Prepare to intubate Followed by infusion at 0-5 mg/kg/hr

Clinical Considerations/Notes:

- 0.2 micron filter must be used when administering phenyTOIN

Seizures - Adult (continued)



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Trauma

Organized systems of trauma care improve mortality for trauma patients[1]

Air Transport from scene should be considered for trauma patients meeting appropriate physiologic and anatomic criteria for serious injury to an appropriate trauma centre if there will be a significant time savings[2]

Utilization of backboards for spinal immobilization during transport should be judicious, so that the potential benefits outweigh the risks. Patients suffering penetrating mechanism of injury (gunshot or stab wound), without a significant blunt trauma mechanism and without neurological symptoms may be transported without spinal precautions. In appropriate cases, spinal precautions can be maintained by application of a rigid cervical collar and securing the patient firmly to the EMS stretcher and may be most appropriate for patients who must be transported for a protracted time, particularly prior to interfacility transfer[3]

Hypotensive trauma patients in hemorrhagic shock[4] should be treated using a damage control resuscitative approach:

- Hypothermia should be prevented, and treated aggressively
- Hemorrhage control should be secured using tourniquets for extremity injury
- Blood component therapy should be considered early, in a 1:1:1 ratio, if possible
- Crystalloids should be minimized, if blood products are available
- Permissive hypotension should be considered for patients suffering penetrating torso injury
- Systolic blood pressure should be 90 mmHg. However, in all cases, perfusion of the brain (level of consciousness) must be maintained

Tranexamic acid (1 g over 10 minutes followed by second 1g in 1 hour) should be administered to trauma patients who are believed to be bleeding, and who are tachycardic or hypotensive (HR > 100, or Systolic BP < 100). This should only be initiated if patient seen within 3 hours of the injury[5]

In the setting of severe traumatic brain injury (GCS <9), hypoxemia (SpO2 <90%) and hypotension (systolic BP <90 mmHg) are associated with increased mortality and should be avoided[13,11]. A MAP ≥80 mmHg should be maintained.

Scene intubation for patients with traumatic brain injury is controversial[14]. It may be reasonable to manage with BLS interventions if they are successful at maintaining a patent airway with appropriate oxygenation and ventilation when transport times to the Lead Trauma Hospital (LTH) are relatively short (<30 min)[6,15-17]

General measures for prevention and treatment of elevated ICP should include elevation of the head of bed to 30 degrees, optimization of venous drainage by keeping the neck in neutral position, using appropriately sized cervical collar, loosening neck braces if too tight, and appropriate management of analgesia, sedation and nausea[18]

Target $PaCO_2$ should be maintained at 35-40 mm Hg (surrogate marker of ETCO2 should be maintained at 33-38 mmHg) and hyperventilation (ETCO2 < 33 mmHg) should be avoided unless the patient shows signs of cerebral herniation. Signs of cerebral herniation include dilated and unreactive pupils, asymmetric pupils, a motor exam that identifies extensor posturing or no response, or progressive neurologic deterioration (decrease in GCS of >2 points from patient's best score of < 9)[7,13,21]

Hyperosmolar agents (hypertonic saline, mannitol) may be considered for patients showing signs of cerebral herniation and may improve cerebral blood flow[8,9,10,19,20]. Mannitol should NOT be used in patients with suspected hypovolemia (tachycardia and/or hypotension).

Hyperventilation can be considered as a second line therapy if there are severe signs of increased ICP (including Cushing's triad with systolic hypertension, bradycardia, and irregular respirations) or signs of cerebral herniation despite the first line therapies listed above. Hyperventilation should target $PaCO_2$ 32-35 (surrogate marker of $ETCO_2$ 30-35).

Hyperoxia (defined by a supranormal arterial O2 tension) may be associated with increased mortality in traumatic brain injury and should be avoided maintaining Sa02 94-98%[12]

Adult Traumatic Cardiac Arrest

Indications:

- Adult patient is vital signs absent (VSA) due to trauma

Contraindications:

- Not applicable

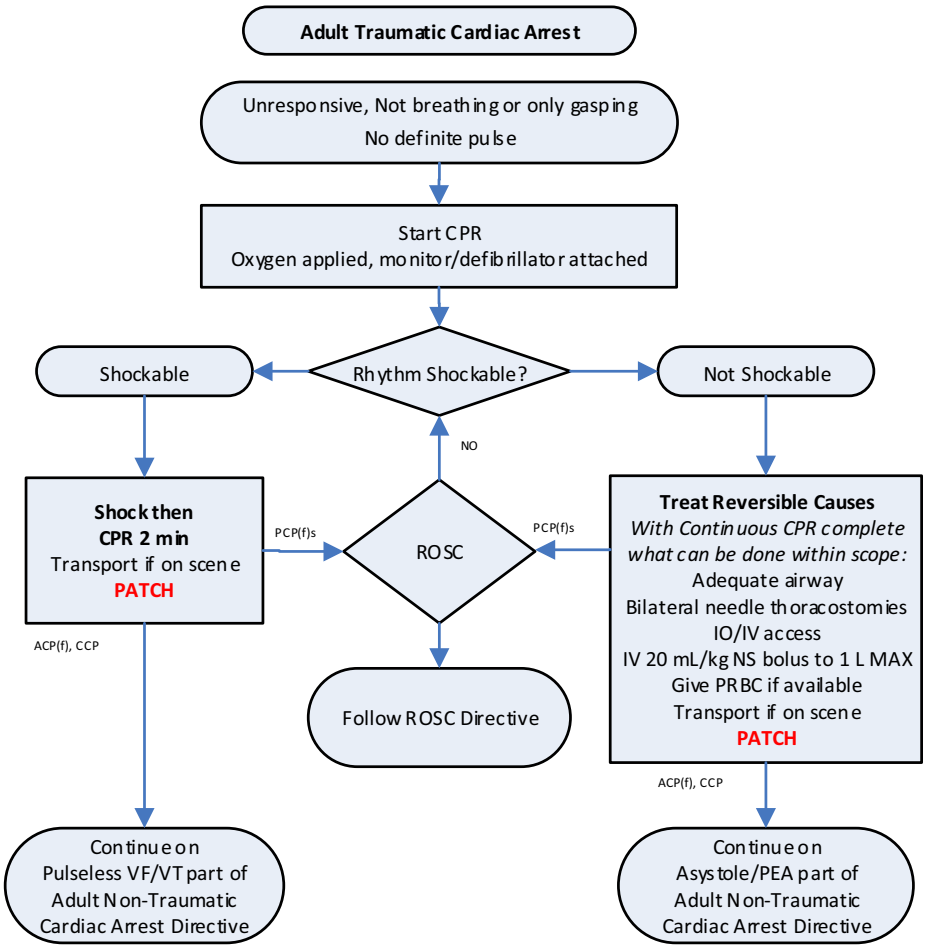
Treatment:

≥ PCP(f)	Initiate then Patch	**Initiate the Traumatic Cardiac arrest algorithm**

Clinical Consideration:

- If this is inter-facility then a STAT patch to the TMP is indicated for further management decision making
- Routinely bind pelvis if MOI suggests potential for pelvic injury
- Perform bilateral needle thoracostomy in acute traumatic arrest

Adult Traumatic Cardiac Arrest (continued)



CPR Quality

- Push hard (≥ 1/3 chest AP diameter: ≥ 5 cm depth
- Push fast (100/min-120/min)
- Ensure full chest recoil
- Minimize/avoid interruptions (even for attempts at advanced airway or IV/IO access)

- Rotate compressors q 2 min
- Rounds of CPR are 2 min in duration concentrating on effective CPR/ventilation, then checking if rhythm is shockable

- Monitor quality of CPR by pulse
- Avoid excessive ventilation
- 30:2 ratio if no advanced airway
- With advanced airway, 10 breaths/min (ventilate q 6 sec) with continuous compressions

Return of spontaneous circulation (ROSC)

- Spontaneous pulse and/or art line pressure waveform in addition to CPR
- Measurable BP
- Abrupt sustained rise in $EtCO_2$ may be an early indication

Note:

- Traumatic Cardiac Arrest: main cause of arrest thought to be due to blunt or penetrating trauma
- For Traumatic arrest assume and treat for common reversible causes of traumatic shock including aggressive fluid bolus for hemorrhage and bilateral needle thoracostomy for possible tension pneumothorax. Routinely bind pelvis if MOI indicates potential for pelvic injury. Rapid transport is key if on scene
- At start of CPR for witnessed or unwitnessed traumatic cardiac arrest, immediately look for a reversible cause to treat (shockable rhythm, hypovolemia, tension pneumothorax)
- Pulse checks are less than 10 seconds. Confirm no definite pulse and no signs of life in less than 10 seconds. Avoid delays or interruptions to CPR
- Rhythm checks are brief (few seconds) to determine if shockable rhythm
- Confirm asystole in 2 leads to differentiate from fine VF
- Prevent hypothermia in trauma to avoid lethal triad of "cold, coagulopathy, acidosis"

Traumatic Brain Injury

Indications:

- Traumatic brain injury

Contraindications:

- Allergy or sensitivity to the medication

Treatment

≥ ACP(f)	Initiate Then Patch	**Norepinephrine (Levophed)**
		0-0.5 microgram/kg/min IV/IO Target MAP > 80

≥ ACP(f)	Mandatory Patch	**Hypertonic Saline (3%)**
		3 mL/kg IV/IO MAX rate of 20 mL/min Consider if MAP < 80 mmHg

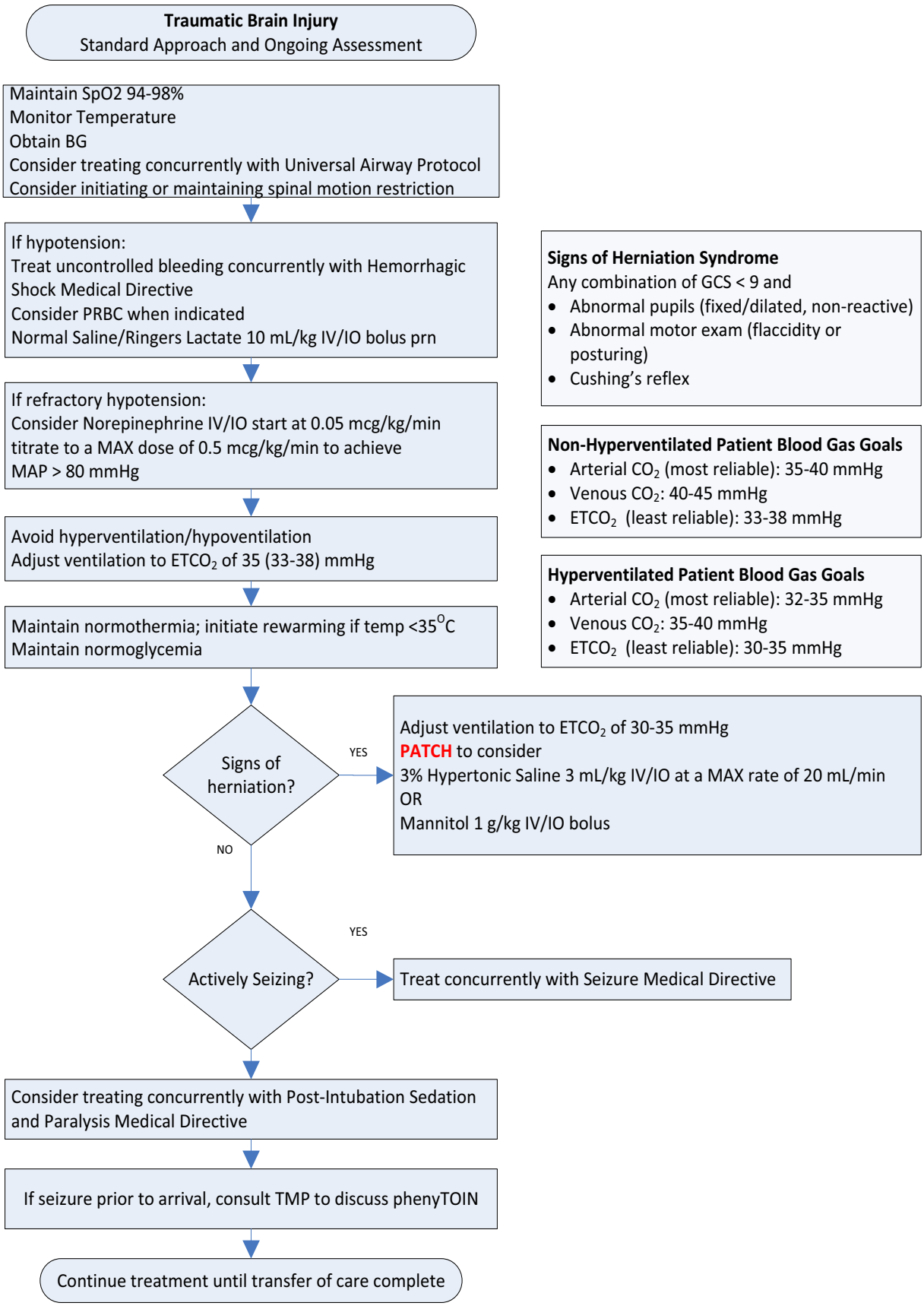
OR

≥ ACP(f)	Mandatory Patch	**Mannitol**
		1 g/kg IV/IO bolus MAP > 80 mmHg

Clinical Considerations/Notes:

- Trauma patients should be kept warm with temperature > 35 degrees

Traumatic Brain Injury (continued)



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Ornge Clinical Practice Guideline: Spinal Cord Injury

Please refer to the Drug Monographs and References document for references listed in the CPGs

Guidelines for management of patients with suspected or known spinal cord injury in the transport setting, using current best practice and best available evidence.

Definition
A spinal cord injury is a partial or complete disruption (suspected or actual) of the spinal cord, resulting in dysfunction (motor, sensor, or both) distal to the level of the disruption.

Guiding Principles
Patients with spinal cord injury are at potential risk of secondary injury due to further disruption of the spinal cord, exhibit loss of motor or sensory function (or both) below the level of injury, and may exhibit hemodynamic and autonomic instability. Management is directed at transporting to definitive care while mitigating further injury and managing physiologic disruption that results due to the injury.

Patients with a known or suspected spinal cord injury should, where possible, be transported directly to a centre designated to manage multisystem traumatic injuries, including spinal cord injuries[5].

Use of spinal boards

- Spinal boards or adjustable break-away stretchers should be considered primarily as extrication/patient lifting devices. The goal should be to remove the patient from these devices as soon as it is safe to do so. If sufficient personnel are present, the patient should be log rolled from the extrication device to the stretcher during loading of the patient or shortly after loading into the ambulance.
- Spinal boards or adjustable break- away stretchers may remain in place if the paramedic deems it safer/ more comfortable for the patient in consideration of short transport times (<30 minutes).

Patients with spinal cord injury may have disruption of motor or sympathetic nerves, resulting in decreased muscle or sympathetic tone distal (caudad) to the disruption. The resulting muscle flaccidity and vasomotor tone may result in hypotension with a variable heart rate response. This condition is referred to as neurogenic or spinal shock[9, 10].

Patients with spinal cord injury may have disruption of sensory pathways, resulting in altered or loss of sensation distal (caudad) to the disruption. The resulting paresthesia makes identification of injury due to pain difficult or impossible. As a result, maintain a high degree of suspicion for hidden injuries such as long bone fractures, pelvic disruption, or intraabdominal (solid organ, hollow viscus) injuries. Other injuries must be definitively excluded before assigning the cause of hypotension to the spinal cord injury.

Early fluid resuscitation is necessary to maintain tissue perfusion, but care must be taken to avoid fluid overload. The first treatment priority for hypotension is crystalloid resuscitation. The intravascular volume should first be restored with fluids, then vasopressors (norepinephrine, phenylephrine) may be used to treat ongoing hypotension[11]. The appropriate resuscitation end point and optimal mean arterial blood pressure for maintenance of spinal cord perfusion are not well known, but use of fluids and vasopressors to achieve a minimum mean arterial pressure of 80 mmHg have been shown to improve outcomes[6,7]. Avoiding hypotension in brain-injured patients is paramount in early treatment because diminished cerebral perfusion pressure may contribute to secondary neuronal injury[8]. Any hypotension should be recognized and treatment initiated promptly with the goal of preventing further hypotension and maintaining a MAP > 80.

No clinical evidence exists to definitively recommend the use of any neuroprotective pharmacologic agent, including steroids, in the treatment of acute spinal cord injury to improve functional recovery[12(435)].

Advanced airway procedures, such as intubation, require special care to ensure that the unstable spine remains aligned. The goal of intubation is to secure the airway with as little movement of the cervical spine as possible. The

standard urgent or emergent intubating technique for someone with a presumed or known cervical spine injury is a rapid sequence induction with manual inline stabilization[12(433)]. Manual inline cervical stabilization does not result in worsening of neurologic status after airway management[15], and results in less cervical movement than a cervical collar alone[16].

Hypoxia or manipulation of the larynx or trachea may cause profound bradycardia or even cardiac arrest in the patients with high spinal cord injuries[13, 14]. Atropine pre-treatment prior to upper airway procedures is appropriate when bradycardia exists prior to airway manipulation. Positive pressure ventilation can cause hypotension[14]. Intravenous volume administration is needed prior to intubation, but additional vasopressor support is frequently required. The use of succinylcholine remains a safe muscle relaxant for use in the first 72 hours following injury, but not thereafter.

Patients with spinal cord injury have a neurologic loss of the ability to void. Even in those with incomplete injuries, urinary retention is common. Place an indwelling urinary catheter as part of the initial patient assessment, unless contraindicated[12(453-454)].

The altered sensation that results from spinal cord injury may result in greater than expected pain, due to mechanisms such as allodynia and neuropathic pain. Minimizing handling of the patient and use of analgesia (opiates) and sedative-hypnotics (benzodiazepines, dissociative agents) in the appropriate dose and interval will relieve pain and anxiety.

Spinal Cord Injury

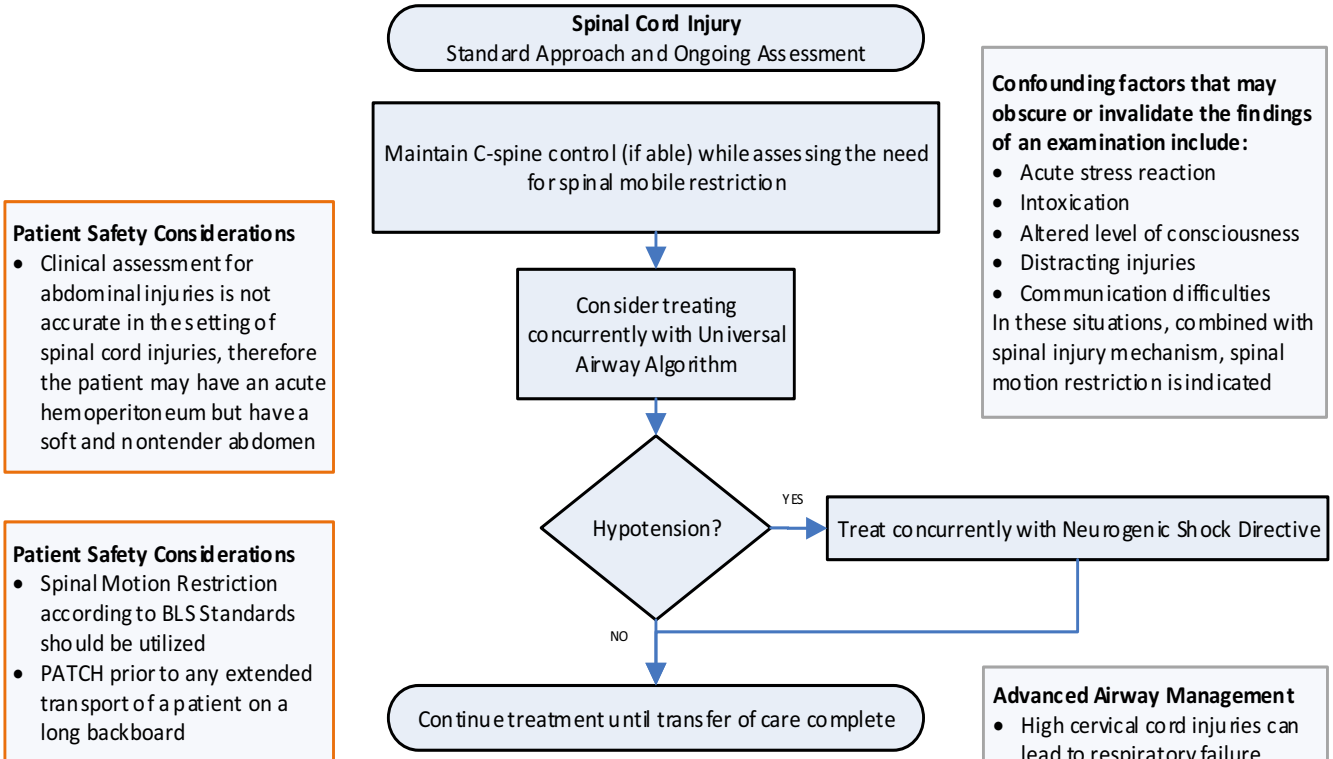
Indications:

- Spinal cord injury

Contraindications:

- Not applicable

Treatment:



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Clinical Considerations/Notes:

- Not applicable

Neurogenic Shock

Indications:

- Neurogenic shock

Contraindications:

- Allergy or sensitivity to the medication

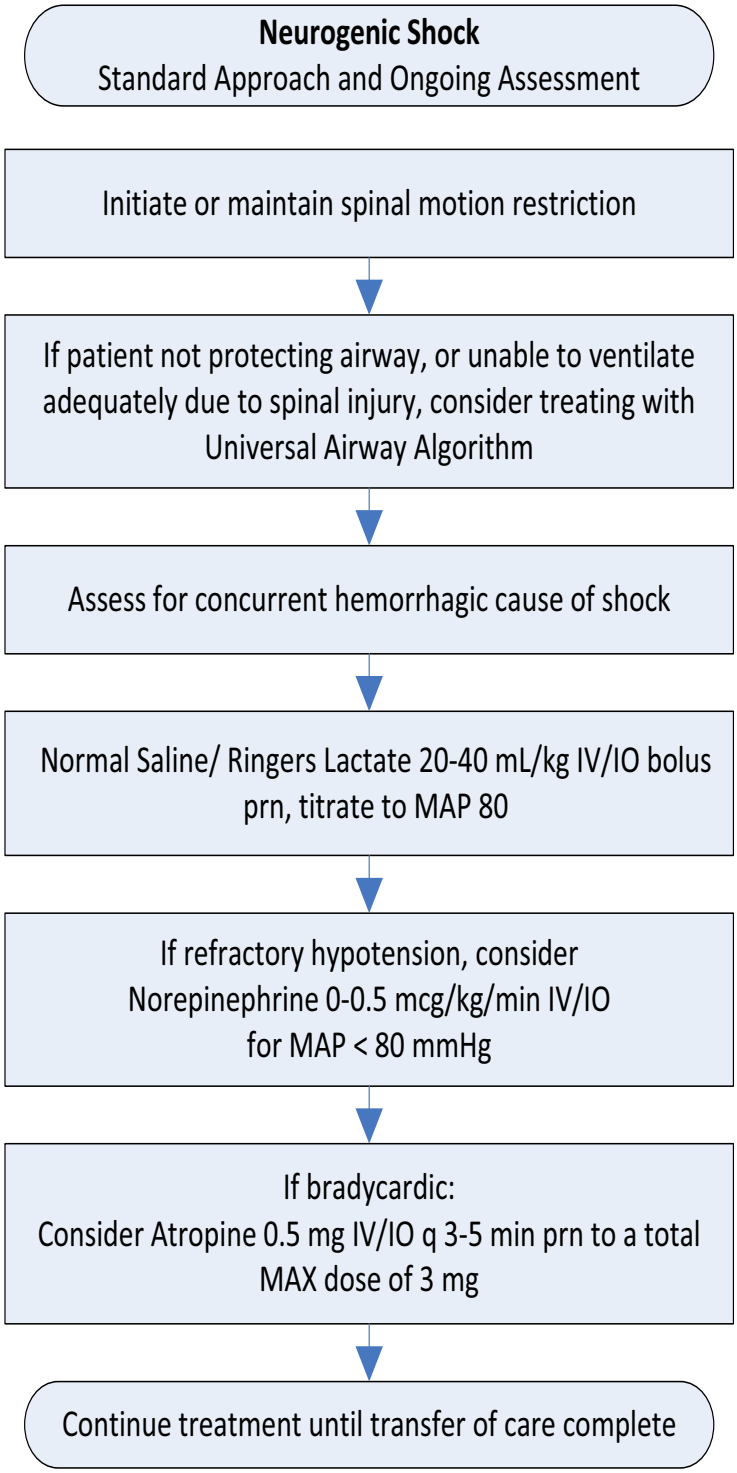
Treatment:

≥ ACP(L) / No patch required	**Normal Saline or Ringers Lactate** 20-40 mL/kg IV/IO bolus Target MAP > 80
≥ ACP(f) / Initiate Then Patch	**Norepinephrine (Levophed)** 0-0.5 microgram/kg/min IV/IO Target MAP > 80
≥ ACP(f) / Initiate Then Patch	**Atropine Sulfate (Atropine)** 0.5 mg IV/IO q 3-5 minutes prn Total MAX dose 3 mg (whichever is less)
≥ ACP(f) / Initiate then Patch	**DOPamine** 5-20 microgram/kg/min IV Target MAP > 80
CCP / Mandatory Patch	**EPINEPHrine (Adrenalin)** 0-0.5 microgram/kg/min IV/IO Target MAP > 80

Clinical Considerations/Notes:

- In neurogenic shock (if not also hypovolemic) there is sufficient alpha activity at low doses of levophed that significant reflex bradycardia may arise due to unopposed vasoconstriction and carotid body stimulation/ vagal tone. In this situation, dopamine may be considered

Neurogenic Shock (continued)



Patient Safety Considerations

- The benefit of long backboard use for spinal immobilization is largely unproven and has been shown to cause injury
- **PATCH** prior to an extended transport time of a patient on a long backboard

Blood Pressure

- Target a minimum MAP of 80 mmHg

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Traumatic Hemorrhagic Shock

Indications:

- Hemorrhagic shock MAP < 65 mmHg with active, ongoing and significant bleeding

Contraindications:

- Allergy or sensitivity to the medication

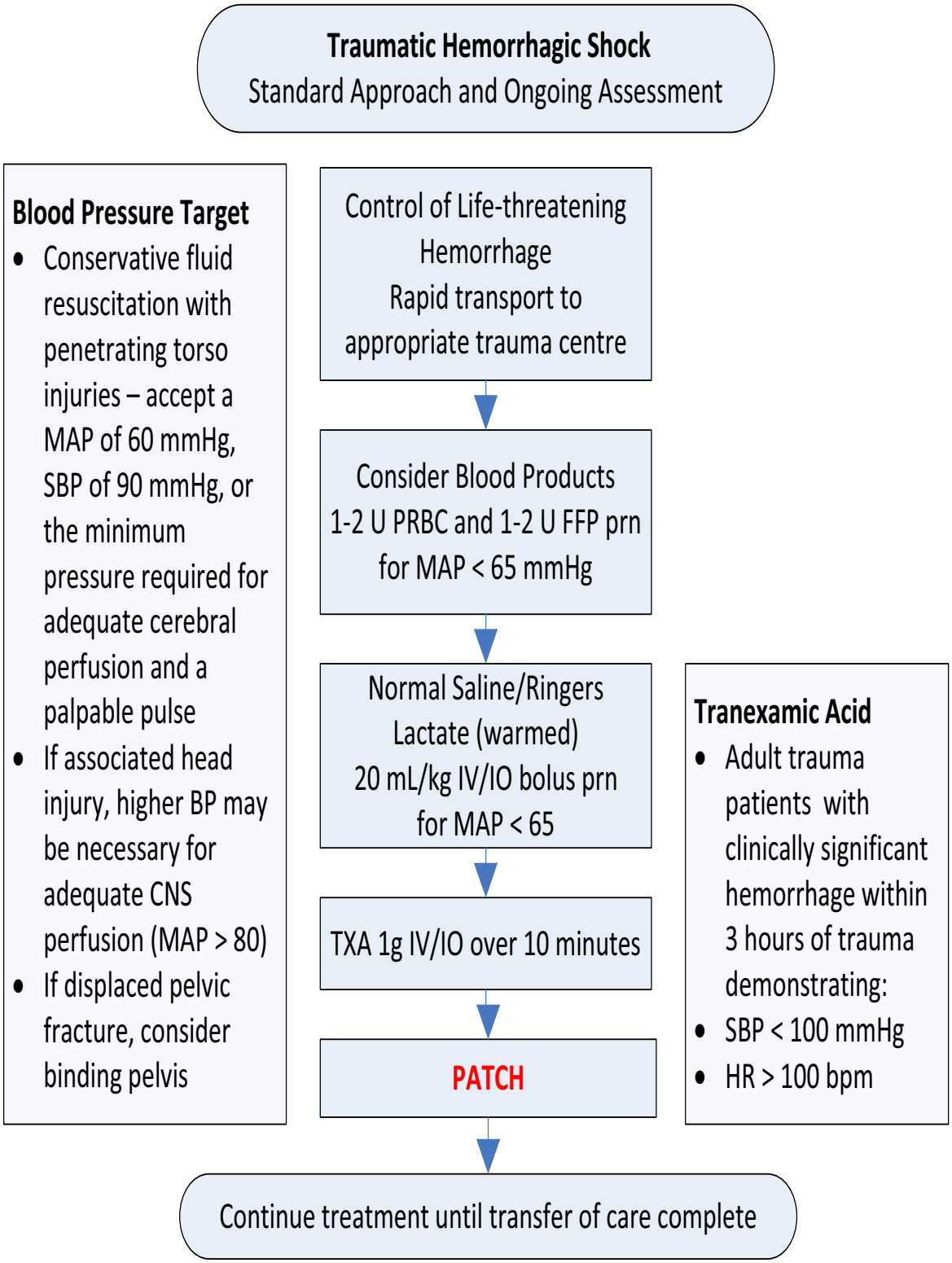
Treatment:

≥ ACP(L) / No patch required	**Normal Saline or Ringers Lactate** 20 mL/kg IV/IO bolus Target MAP > 65

≥ ACP(f) / Initiate Then Patch	**Consider PRBCs and TXA** **See Blood Product Administration Medical Directive and TXA Medical Directive**

Clinical Considerations/Notes:

- Avoid hypothermia. Keep patient's temperature above 35^{o}C



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Blood Product Administration

Blood Product Administration

Indications:

- Hemorrhagic shock MAP < 65 mmHg with active, ongoing and significant bleeding
- Hemoglobin < 70 grams/litre with evidence of circulatory compromise
- TMP judgement

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(f) / Mandatory Patch	Packed Red Blood Cells (PRBC)	Fresh Frozen Plasma (FFP)
	1-2 PRBC to maintain MAP > 65 mm Hg or Hgb > 70 as directed	2 U for every 2 U PRBC delivered

CCP / Initiate then Patch	PRBC	FFP
	1-2 PRBC to maintain MAP > 65 mm Hg or Hgb > 70 as directed	2 U for every 2 U PRBC delivered

Clinical Considerations/Notes:

- Contact the TMP to request Packed Red Blood Cells (PRBCs) at the scene. This would only be indicated in very rare individual circumstances i.e. uncontrolled hemorrhagic shock despite adequate crystalloid resuscitation, prolonged out-of-hospital time (i.e. prolonged extrication) and no significant delay to arrival to patient caused by waiting to retrieve the blood
- Ensure all available identifiers (i.e. name, blood type, patient number, etc) are checked to ensure correct blood product transfusion
- Once any of the above products are administered, the blood product form must be completed and submitted to the receiving institution, so that they are aware
- Informed consent for blood product administration must be obtained if Ornge initiates the blood product (please refer to the consent form in the Clinical Affairs P&P manual) except in life threatening circumstances
- Please note, if immediate PRBCs are required for an unstable patient request Type O blood if available (O Negative for women of child bearing age)

Reversal of Warfin/Coumadin

Indications:

- Prothrombin Complex Concentrate (PCC) if emergency reversal of Warfarin therapy (intracranial bleed, emergency surgery, life threatening bleed) AND INR >1.5
- Life-threatening hemorrhage (i.e., ICH, major trauma, GI bleed requiring RBC transfusion)
- Emergency surgery

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(f) | Mandatory Patch

Prothrombin Complex Concentrate (PCC)*		
Initiate or maintain the administration of PCC		10 mg of IV Vitamin K (via slow IV infusion ≤ 1 mg/min) MUST be administered either before or during the infusion of PCC for maintenance
The usual dose of **Octaplex** is:		
50-90 kg	INR 1.5 - 3.0	1000 IU (40 mL)
50-90 kg	INR > 3.0	2000 IU (80 mL)
> 90 kg	INR > 1.5	2000 IU (80 mL)

***PCC is a blood product and requires transfusion consent**

Clinical Considerations/Notes:

- The most commonly used Prothrombin Complex Concentrate (PCC) is Octaplex but some facilities may also use Beriplex

Direct Oral Anticoagulant/Novel Oral Anticoagulants Reversal

Indications:

- Life-threatening hemorrhage (i.e., ICH, major trauma, GI bleed requiring RBC transfusion)
- Emergency surgery

Contraindications:

- Allergy or sensitivity to the medication

Treatment

≥ ACP(f) / Mandatory Patch	**Idarucizumab**
	For Dabigatran (Pradaxa) only
	5 grams (2 x 2.5 vials) in 100 mL over 10 minutes by bolus infusion Compatible with NS

≥ ACP(f) / Mandatory Patch	**Prothrombin Complex Concentrate (PCC)***
	For Rivaroxaban (Xarelto) / Apixaban (Eliquis) only
	2000 IU and repeat 2000 IU at 1 hour if ongoing bleeding

*PCC is a blood product and requires transfusion consent

≥ ACP(f) / Mandatory Patch	**Tranexamic Acid (TXA)**
	For Rivaroxaban (Xarelto) / Apixaban (Eliquis) only
	1 g and repeat in 1 hours (2nd bolus of 1g in 1 hour)

Clinical Considerations/Notes:

- Not applicable

Tranexamic Acid (TXA) Administration

Indications:

- Treatment of trauma-associated hemorrhage, management of massive bleeding, or prophylaxis of systemic or local hyperfibrinolysis

Contraindications:

- Known hypersensitivity to TXA
- Greater than 3 hours from time of injury to drug administration (for traumatic injury)

Treatment:

		Tranexamic Acid (TXA)	
≥ ACP(f)	Initiate then Patch	Initiate if the following indications are met: • Administration is limited to definite knowledge of <3 hours from time of injury • HR ≥ 100 bpm or SBP ≤ 100 mmHg	1 gram loading dose (over 10 minutes) repeat 1g bolus in 1 hour

Clinical Considerations/Notes:

- If active bleeding persists, additional 1 gram bolus doses of TXA may be indicated. Discuss with TMP.

Shock States

Push Dose EPINEPHrine (10 mcg/ml = 1: 100 000)

Indications:

- Temporary improvement of circulation in peri-arrest or shock states with severe hypotension and/or bradycardia

Contraindications:

- Patients in cardiac arrest

Treatment:

CCP / IMandatoryPatch	EPINEPHrine (Adrenalin) 10 mcg/ml - 1: 100 000
	5-20 mcg IV/IO q 2-5 minutes PRN Target MAP >65

Clinical Considerations/Notes:

- Epinephrine 1: **100** 000 may provide temporary stabilization while other therapies are added or adjusted/ titrated

Preparation of Push Dose Epinephrine - 10 mcg/ml concentration

1. 1. Using a 10 mL syringe, draw 100 microgram (i.e. 1 mL of 1:10,000) EPINEPHrine and dilute in 9 mL of Normal Saline

Hypovolemic Shock

Indications:

- Hypotensive as defined by a MAP < 65 mmHg as a result of hypovolemia

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(L)	Initiate then Patch	**Normal Saline or Ringers Lactate** 20 mL/kg IV/IO bolus MAX 1 Litre REPEAT bolus if patient continues to be symptomatically hypotensive Target MAP > 65

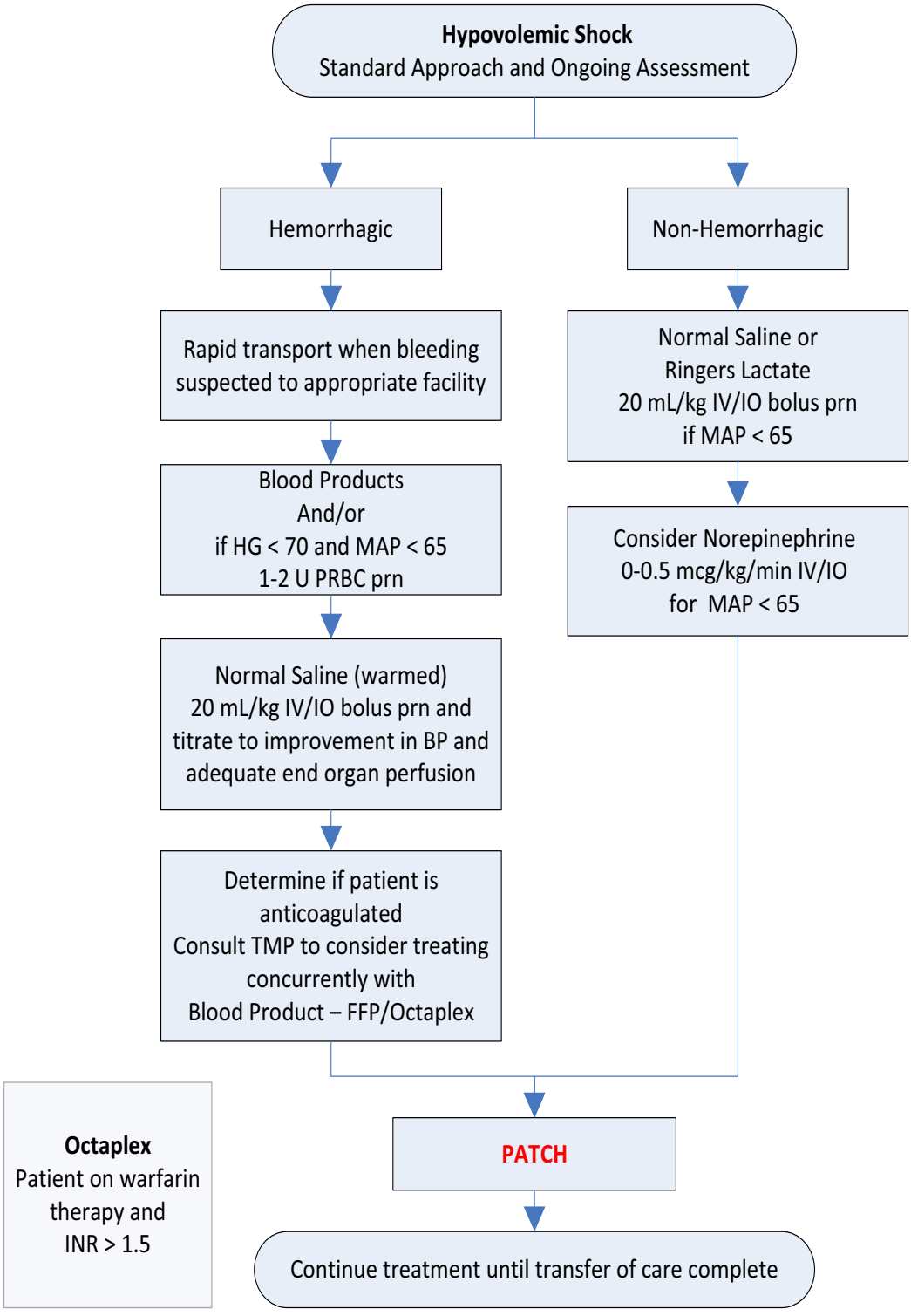
≥ ACP(f)	Initiate Then Patch	**Norepinephrine (Levophed)** 0-0.5 microgram/kg/min IV/IO Target MAP > 65

≥ ACP(f)	Intentionally Left Blank	**Consider PRBCs and FFP** **See Blood Product Administration Medical Directive**

Clinical Considerations/Notes:

- Following consultation with the TMP, volume replacement therapy, can be continued by the ACP(f), CCP and PCCP/PCCN with the intent of keeping the patient's MAP within a normotensive range (i.e. ≥ 65 mmHg). Severe hypovolemia from blood loss should prompt consideration for early use of blood products including both packed red blood cells and fresh frozen plasma in cases of massive transfusion (see Blood Product Administration Medical Directive)
- In setting of hemorrhage consider early blood component therapy (BCT) and limit crystalloid to 1L - use NS for BCT
- Avoid crystalloid in large doses in hemorrhagic shock particularly in trauma
- Crystalloids are indicated in hemorrhagic shock if delay for blood with hypotension and altered mentation
- Consider TXA if severe hemorrhagic shock

Hypovolemic Shock (continued)



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Ornge Clinical Practice Guideline: Sepsis

Please refer to the Drug Monographs and References document for references listed in the CPGs

1. Actively look for symptoms and signs of sepsis in all patients transported by Ornge. Case definitions of sepsis include suspected or documented infection along with SOFA score >2
2. All patients with sepsis should be risk stratified by determining whether they meet criteria for septic shock-sepsis with persisting hypotension requiring vasopressors to maintain MAP >65 mmHg and having a serum lactate level >2 mmol/L despite adequate volume resuscitation
3. All patients with sepsis should be evaluated for compliance with the Surviving Sepsis Campaign guidelines bundles:
    a. Measure lactate level
        i OCC CO should document the most recent lactate level during call taking for all patients identified with sepsis
        ii If a lactate level is not available, the serum bicarbonate and anion gap can be documented as a surrogate to rule out most cases of elevated lactate (normal HCO3 and normal anion gap make significant lactic acidosis unlikely)
        iii OCC CO and/or the TMP should request the sending to obtain a lactate level if possible prior to paramedic arrival taking into account resources at the sending facility and avoiding any delays in transport
        iv If a point-of-care laboratory device is available to the Ornge crew, a lactate level should be measured and documented upon patient contact if no recent lactate level is available from the sending facility
        v ETCO2 level may be measured and documented in the absence of an available lactate level as an alternate method of determining acid/base status (lower ETCO2 usually correlates with lower serum bicarbonate levels as a form of compensation unless the patient's respiratory drive is suppressed)
    b. Obtain blood cultures prior to administration of antibiotics
        i Yield of blood cultures is reduced if antibiotics are given prior to obtaining cultures, which complicates antimicrobial stewardship efforts and may add to patient risk if resistance patterns are not identified
        ii OCC CO and/or TMP should determine whether blood cultures have been obtained at the sending facility, and if not, encourage the sending facility to obtain and process the samples
        iii In the event that a sending facility cannot process blood cultures but can obtain samples, the OCC CO and/or TMP should determine whether inoculated blood culture bottles can be transported for further processing at the receiving facility to facilitate and effect culture sampling and avoid delays in antibiotic administration.
    c. Administer broad spectrum antibiotics
        i Delays in antibiotic therapy are associated with increased risk of mortality for patients with sepsis
        ii Administration of antibiotics that do not treat the ultimately identified organism(s) is associated with increased risk of mortality for patients with sepsis
        iii Through early contact with the sending facility, the OCC CO and the TMP should collaboratively determine the most likely source of infection and determine whether appropriate antibiotics have been administered
        iv Ornge crews should review the medical history, including any potential culture or imaging results that would assist the TMP in confirming appropriate antibiotic therapy has been provided
        v The TMP and the Ornge crew should review the case during patch and, if appropriate antibiotics have not been given, should order those to be administered during transport when feasible
    d. Administer at least 30 mL/kg of crystalloid for hypotension and/or lactate > 4 mmol/L
        i Hypotension is defined as a systolic BP < 90 mm Hg/MAP < 65 mm Hg or a drop in more than 40 mg Hg from baseline (important to note for patients with baseline hypertension, as a systolic BP of > 90 mm Hg may represent significant hypotension associated with hypoperfusion)
        ii All patients with hypotension or lactate > 4 mmol/L should receive at least 30 mL/kg of crystalloid
        iii Isotonic crystalloid is the fluid of choice for treatment of hypotension associated with septic shock to improve preload associated with venodilatation and capillary leak

iv 0.9% Normal Saline or Ringer's Lactate are the usual bolus fluids to be used for resuscitation from septic shock
v Large volumes of Normal Saline may induce a hyperchloremic metabolic acidosis (pH 5.5), therefore consideration for use of Ringer's Lactate (pH 6.5) is reasonable when large volume (> 30mL/kg) crystalloid resuscitation is anticipated
vi Large bore peripheral IV access should be used if possible to rapidly deliver fluid boluses in septic shock
vii Reliance on infusion pumps with infusion rates limited to 1200 mL/h should be avoided due to the suboptimal rate of fluid resuscitation
viii Pressure bags can be considered to assist in the rapid infusion of fluids during resuscitation from septic shock; a manual blood pressure cuff can be substituted when pressure bags are not available
ix Consider insertion of an intraosseous needle to facilitate fluid resuscitation when adequate large bore peripheral IV access cannot be achieved
x Artificial colloids do not improve outcomes compared with crystalloid resuscitation in patients with septic shock, and may be associated with increased risk of renal dysfunction and coagulopathy
xi Artificial colloids (i.e., Pentaspan, Voluven) should not be administered to patients in septic shock
xii There is no convincing evidence for clinical benefit from routine use of albumin as resuscitation fluid compared with crystalloid in patients with septic shock, therefore albumin (5% or 25%) should not be used as the primary resuscitation fluid in septic shock and reserved for use only in isolated cases with specific indications (i.e., severe hypoalbuminemia)

e. Add vasopressors for refractory hypotension despite at least 30 mL/kg of crystalloid targeting MAP > 65 mm Hg
i Vasopressor can be used prior to completion of bolus in cases of profound shock or hypoperfusion
ii Norepinephrine is the vasopressor of choice for managing refractory hypotension in septic shock
iii EPINEPHrine infusion may be used as an additional vasopressor for cases of refractory hypotension despite high doses of norepinephrine or when poor cardiac contractility (LV or RV) is clinically suspected (CCP crew only)
iv Vasopressin infusion may be used as an additional vasopressor for cases of refractory hypotension despite high doses of norepinephrine in the absence of clinically suspected poor contractility (CCP crew only)
v DOPamine should be reserved for septic shock patients with bradycardia and/or as a second vasopressor agent in patients with hypotension refractory to high dose norepinephrine being transported by an ACP(f) crew
vi Patients on high rates of norepinephrine infusion at the sending facility should generally be transported by a CCP crew to allow additional flexibility for additional vasopressor agents not available to an ≥ACP(f) When a CCP crew is assigned to transport a patient with septic shock requiring vasopressor support, the TMP should consider encouraging placement of an arterial line by the sending facility prior to Ornge crew arrival when the sending facility has staff trained and available for arterial line insertion
vii When a patient is requiring ongoing vasopressor support, the TMP should consider requesting placement of a central venous catheter by the sending facility prior to Ornge crew arrival when the sending facility has staff trained and available for central line insertion
viii When a patient is requiring ongoing vasopressor support with poor peripheral IV access and no possibility of timely central venous line insertion, the TMP should consider recommending placement of an intraosseous needle by the sending facility or the Ornge crew
ix Failure to improve blood pressure with increasing doses of vasopressors should prompt consideration of adjunctive treatments such as:
- Additional fluid resuscitation
- Calcium supplementation to improve vasomotor tone (suspected or confirmed with corrected Ca < 2.2 or ionized Ca < 1.0)
- Corticosteroids (suspected adrenal insufficiency, history of chronic use of steroids, hypotension refractory to fluids and vasopressors)

- Transfusion for untreated anemia (Hb < 70 g/L = need for transfusion to increase oxygen delivery)
- Addition of an inotrope to improve cardiac contractility, such as DOBUTamine or an additional pressor with inotropic properties (i.e., EPINEPHrine or DOPamine)
- Treatment of other causes of shock (i.e., primary cardiogenic, hemorrhage, obstructive shock such as pericardial tamponade/massive pulmonary embolism/tension pneumothorax)

f. In the event of persistent hypotension after initial fluid administration (MAP < 65 mm Hg) or if initial lactate was ≥4 mmol/L, re-assess volume status and tissue perfusion and document findings according to the following recommendations:
   i DOCUMENT REASSESSMENT OF VOLUME STATUS AND TISSUE PERFUSION WITH:
      - Repeat focused exam (after initial fluid resuscitation) including vital signs, cardiopulmonary status, capillary refill, pulse, and skin findings (i.e., mottling)

g. Re-measure lactate if initial lactate elevated
   i Reassess lactate in 1-2 hour intervals (not relevant for short transport times, should be repeated if it has been at least 2 hours since last level if possible)
   ii > 10% reduction in lactate level from baseline is reassuring
   iii Lactate level that is increasing or failing to decrease should prompt assessment for causes of refractory shock
      - Untreated anemia (Hb < 70 g/L = need for transfusion to increase oxygen delivery)
      - Impaired cardiac contractility, consider addition of inotrope such as DOBUTamine or other pressor with inotropic effect (i.e., EPINEPHrine or DOPamine)
      - Other causes of shock (i.e., primary cardiogenic, hypovolemia/hemorrhage, obstructive shock such as pericardial tamponade/massive pulmonary embolism/tension pneumothorax)

Septic Shock

Indications:

- Septic shock (MAP < 65)

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(L) / No patch required	**Normal Saline or Ringers Lactate**
	30 mL/kg IV/IO bolus Target MAP > 65

≥ ACP(f) / Initiate Then Patch	**Norepinephrine (Levophed)**
	0-0.5 microgram/kg/min IV/IO Target MAP > 65

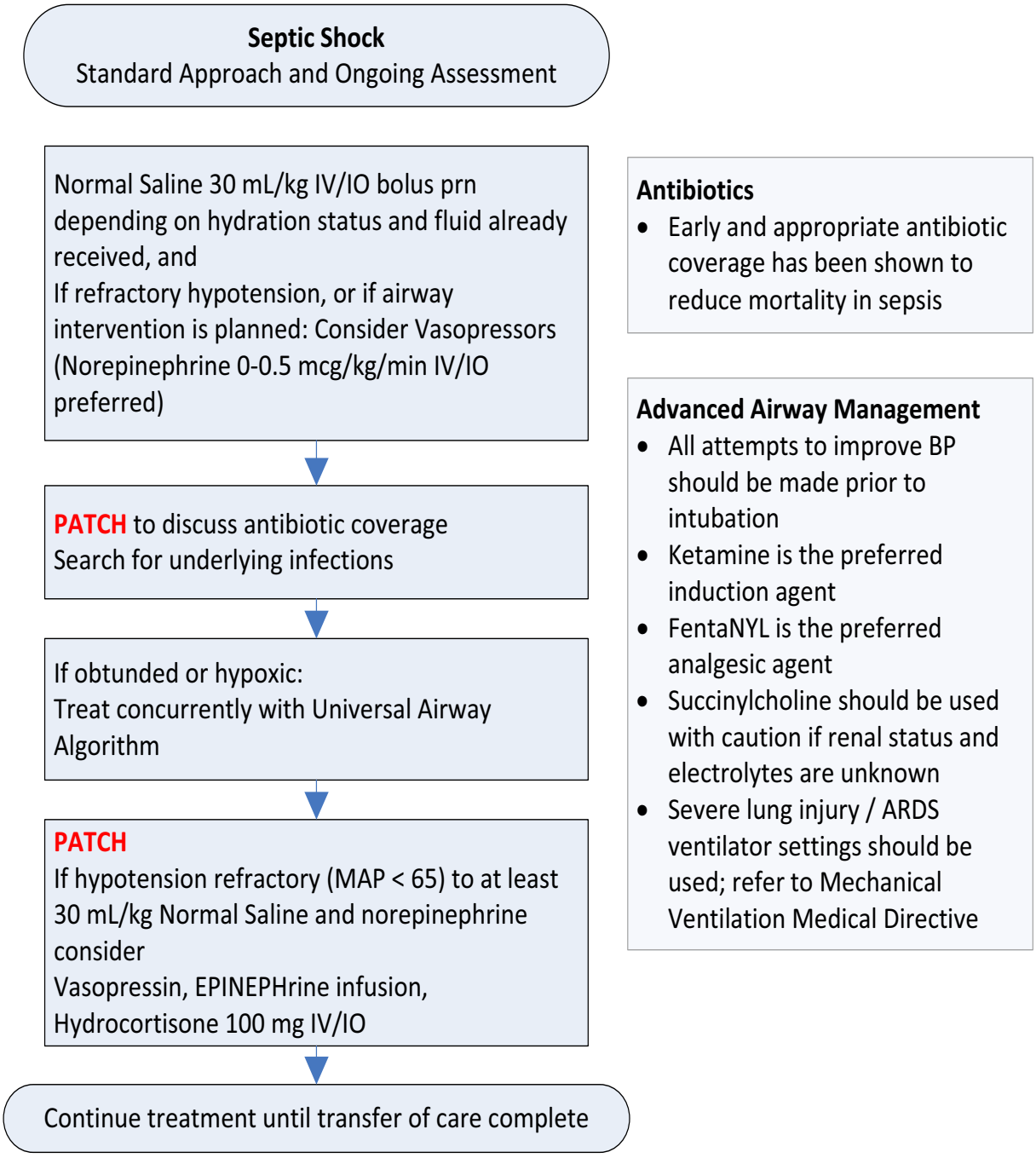
CCP / Mandatory Patch	**Vasopressin**
	0-0.04 units/min IV/IO Target MAP > 65 Vasopressin is typically a fixed rate infusion - not titrated

CCP / Mandatory Patch	**EPINEPHrine (Adrenalin)**
	0-0.5 microgram/kg/min IV/IO Target MAP > 65

≥ ACP(f) / Mandatory Patch	**Hydrocortisone**
	100 mg IV/IO

Clinical Considerations/Notes:

- Consider 1 g CaCl in 100 mL NS/1 hour if ionized Ca < 1 or Ca < 2.0 (corrected if available)
- For patients that are profoundly hypotensive with MAP <50 or pre-arrest consider emergent TMP patch to discuss epinephrine 1: 100 000 and start Norepinephrine infusion at minimum 0.3 mcg/kg/min. Crystalloid bolus should be given concurrently with push dose pressors and/or Norepinephrine infusion initiation
- If Hydrocortisone not available consider Methylprednisolone 125 mg IV/IO



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Extravasation of Vasopressors from Peripheral IV Infusion

Indications:

- Extravasation of norepinephrine, epinephrine, dopamine, DOBUTamine, vasopressin, or phenylephrine from peripheral IV site

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(f)	Initiate then Patch	**Phentolamine** (within 12 hour of extravasation)
		0.1 mg/kg to a max of 10 mg in 9 mL of NS (using a different syringe should be injected) half through the problematic IV catheter over 60 seconds and half as a Sub Q injection around the site using a 25G – 30G needle into any area where tissue discoloration or swelling is seen

Clinical Considerations/Notes:

- Extravasation of vasopressors may potentially cause necrosis of tissue around the IV site or possibly compartment syndrome. Whenever possible, a central line should be used. If peripheral IV access is the only route available, try to avoid the hand or wrist whenever possible. Any IV pressor site should be kept visible and examined q 15 minutes to assess for extravasation
- The phentolamine may cause systemic hypotension, but should be addressed if the secondary IV site is running the original pressor

Gastrointestinal / Genitourinary (GI/GU)

Nausea, Vomiting and Motion Sickness

Indications:

- Nausea, vomiting, or prevention of motion sickness

Contraindications:

- Allergy or sensitivity to the medication
- Received dimenhyDRINATE or Ondansetron within the last 4 hours
- Prolonged QT interval or concomitant use of other drugs that may prolong the QT interval (specific to Ondansetron)

Treatment:

≥ PCP(f) / No Patch Required	**dimenhyDRINATE (Gravol)**
	50 mg IM/PO

≥ ACP(L) / No Patch Required	**dimenhyDRINATE (Gravol)**
	50 mg IM/PO OR 50 mg/10 mL NS IV over > equal 5 minutes

OR

≥ ACP(f) / No PatchRequired	**Ondansetron (Zofran)***
	4 mg IM q 4-8 hours prn OR 4 mg IV in 50-100 mL NS over ≥ 15 minutes q 4-8 hours prn

***Black box warnings due to risk of prolonged QT**

- All IV doses must be diluted in 50–100 mL of saline or other compatible fluid
- All IV doses must be infused over no less than **15 minutes**

Clinical Considerations/Notes:

- dimenhyDRINATE should be administered SLOW IV push to prevent vertigo, weakness and dizziness

Gastric (NG or OG) Tubes

Indications:

- Actual or anticipated need to evacuate gastric contents
- Intubated and ventilated patients or SGA being used for transport

Contraindications:

- Nasogastric -Patients presenting with facial smash or suspected basal skull fracture

Treatment:

≥ PCP(f)	No Patch Required	**Maintenance Only** Ensure the gastric tube is appropriately located via auscultation

≥ ACP(f)	No Patch Required	**Insertion and/or Maintenance** Ensure the gastric tube is appropriately located via auscultation Confirm by partner prior to departure

Clinical Considerations/Notes:

- Insertion should not delay transport

Gastrointestinal Bleed

Indications:

- Treatment of gastrointestinal bleed

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(L) / No patch required	**Normal Saline or Ringers Lactate**
	20 mL/kg IV/IO bolus Target MAP > 65

≥ ACP(f) / Intentionally Left Blank	**Consider PRBC**
	See Blood Product Administration Medical Directive

≥ ACP(f) / No Patch Required	The paramedic may continue a **Pantoprazole** and/or **Octreotide** infusion from sending facility

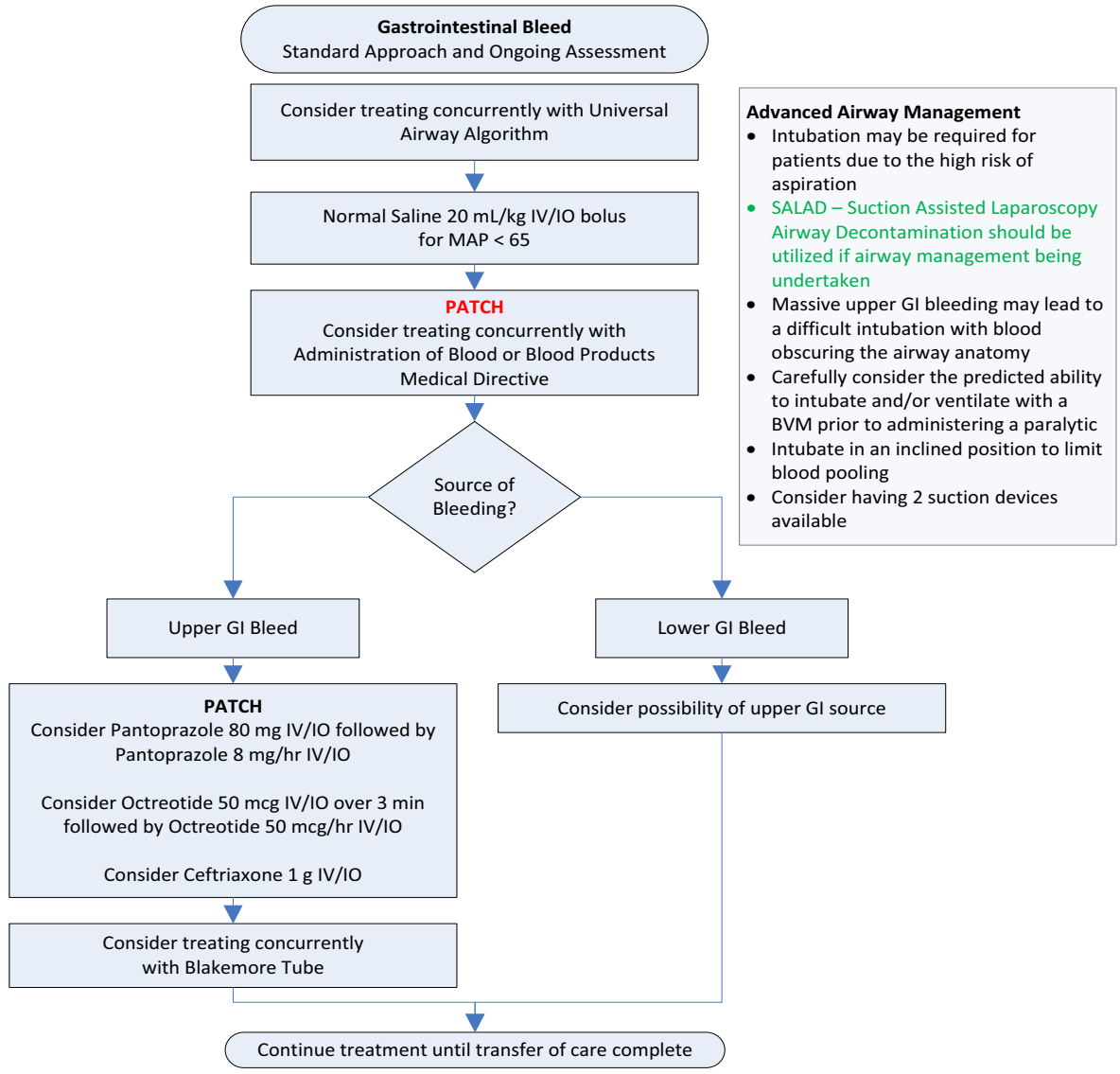
≥ ACP(f) / Mandatory Patch	**Pantoprazole**	
	Bolus	Infusion
	80 mg IV/IO followed by infusion	8 mg/hr IV/IO

≥ ACP(f) / Mandatory Patch	**Octreotide**	
	Bolus	Infusion
	50 microgram IV/IO over 3 minutes followed by infusion	50 microgram/hr IV/IO

Clinical Considerations/Notes:

- Consider Ceftriaxone 1 g IV/IO

Gastrointestinal Bleed (continued)



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Gastroesophageal Balloon Tamponade Devices (Blakemore Tube)

Indications:

- Patients who have a gastroesophageal balloon tamponade device (i.e. Sengstaken-Blakemore Tube) in place

Contraindications:

- Not applicable

Treatment:

CCP	Mandatory Patch	
		If the patient is not intubated, scissors should be readily available to cut the port for balloon deflation should the tube and balloon be pulled back into the pharynx, resulting in a hypopharyngeal occlusion

Clinical Considerations/Notes:

- Ideally the patient should be intubated and sedated to increase patient tolerance and comfort
- Maintain 1 kg of traction with BVM mask and forceps
- Esophageal balloon pressure should be monitored and should remain between 25-45 mmHg. (35-60 cm H_2O) Conversion of mmHg to cm H_2O = multiply X 1.36

Esophageal Temperature Probes

Indications:

- Continuous monitoring of core body temperature for any intubated patient with a temperature outside normal range (36.5 to 37.5^{o}C)
- Temperature monitoring during active rewarming measures
- Continuous monitoring may be ordered by the TMP at their discretion
- Required for targeted temperature management in ROSC

Contraindications:

- Esophageal strictures
- Esophageal varices
- Esophageal perforation
- Congenital anomalies such as tracheal esophageal fistula
- Post-Operative tonsil and adenoidectomy patients
- Facial trauma
- Patients receiving Anticoagulants. Anticoagulants include but are not limited to: IV Heparin, Warfarin (Coumadin), Enoxaparin (Lovenox)

Treatment:

≥ ACP(f)	No Patch Required	**Insert and monitor core temperature with Esophageal Temperature probe**

Clinical Considerations/Notes:

- It is preferable to assess position of probe using a CXR but should not delay transport

Urinary Catheter Insertion and Maintenance

Indications:

- For monitoring urine output
- For urinary tract obstruction

Contraindications:

- Blood at the urethral meatus
- Perineal or scrotal hematoma
- Suspected urethral tear
- High riding prostate

Treatment:

≥ PCP(f)	No Patch Required	**Maintenance Only**

≥ ACP(f)	No Patch Required	**Insertion and/or Maintenance**

Clinical Considerations/Notes:

- Urinary catheter removal can only be performed by the ACP(f), CCP and PCCP/PCCN
- If during transport the catheter becomes obstructed contact the TMP

Environmental and Metabolic

Fever

Indications:

- Fever - temperature >38^{O}C

Contraindications:

- Acetaminophen within the last 4 hours
- Ibuprofen:
- NSAID or Ibuprofen use within previous 6 hours
- Patient on anticoagulation therapy
- Current active bleeding
- Hx of peptic ulcer disease or GI bleed
- Pregnant
- If asthmatic, no prior use of ASA or other NSAIDs
- CVA or TBI in the previous 24 hours
- Known renal impairment
- Active vomiting
- Unable to tolerate oral medication

Treatment:

PCP(f)	No Patch Required	**Acetaminophen (Tylenol)**	
		40 to 60 kg	15 mg/kg PO every 4 hours
		≥ 60 kg	975 -1000 mg PO/PR every 4 hours

PCP(f)	No Patch Required	**Ibuprofen (Advil)**	
		≥ 40 kg	400 mg

Clinical Considerations/Notes:

- Total acetaminophen dose in 24 hours is not to exceed the lesser of 75 mg/kg or 4 grams

Anaphylaxis

Indications:

- Confirmed or suspected history of exposure to an allergen
  AND
- Signs and symptoms of a severe life-threatening anaphylactic reaction

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ PCP(f)	Initiate then Patch	**EPINEPHrine (Adrenaline) 1:1000 Solution**
		0.01 mg/kg IM in anterolateral thigh (min 0.1 mg to max 0.5 mg) May repeat x 1 after 5 minutes Use caution in elderly and those with CAD

≥ PCP(f)	Initiate then Patch	**Salbutamol (Ventolin) Solution Via Nebulized Aerosol (2.5 mg/2.5 mL)**
		5 mg q 5-15 minutes x 3 prn

*Total volume of Salbutamol and Normal Saline should be 5.0 mL

≥ PCP(f)	Initiate then Patch	**Salbutamol (Ventolin) MDI (100 microgram/puff)**
		8 puffs (4 breaths or 45 seconds between each administration) may repeat x 3 q 5-15 minutes prn

≥ PCP(f)	No Patch Required	**diphenhyDRAMINE (Benadryl)**
		1 mg/kg/dose IM MAX of 50 mg/dose

≥ ACP(L)	No Patch Required	**diphenhyDRAMINE (Benadryl)**
		1 mg/kg/dose IV/IM MAX of 50 mg/dose

Anaphylaxis (continued)

≥ ACP(f) / Mandatory Patch	methylPREDNISolone Sodium Succinate (Solumedrol)
	125 mg IV/IO

For Persistent Hypotension with MAP <65 mm Hg

≥ ACP(L) / Initiate then Patch	Normal Saline or Ringers Lactate
	20 mL/kg IV/IO bolus MAX 1 Litre REPEAT bolus if patient continues to be symptomatically hypotensive Target MAP > 65

CCP / Mandatory Patch	EPINEPHrine (Adrenalin)
	0-0.5 microgram/kg/min IV/IO Target MAP > 65

Clinical Considerations/Notes:

- May need EPINEPHrine infusion for refractory anaphylaxis
- Consider histamine antagonists such as Ranitidine

Hypoglycemic Emergencies

Indications:

- Altered level of consciousness (GCS <14)
- Blood glucose < 4 mmol

Contraindications:

- Allergy or sensitivity to the medication
- Pheochromocytoma is a contraindication to glucagon

Treatment:

≥ PCP(f) Initiate then Patch	**Glucagon for Hypoglycemia**	
	1 mg IM (1 mL)	**Repeat blood glucose measurement** **20 minutes after the administration of Glucagon** Follow with oral carbohydrates **ASAP** if LOC permits (i.e. a meal or snack)

≥ ACP(L) Initiate then Patch	**50% Dextrose for Hypoglycemia**	
	25 g of $D_{50}W$ IV (50 mL $D_{50}W$)	Repeat blood glucose measurement 10 minutes after the administration of Dextrose IV Follow with oral carbohydrates **ASAP** if LOC permits

After the administration of Glucagon and/or Dextrose, if an IV is present, the ACP(L), and CCP should begin an infusion of $D_{10}W$ or $D_{10}NS$ at 100 mL/hr (the accompanying preparation table identifies the process for creating a 10% Dextrose solution).

10% Dextrose Solution		
IF YOU HAVE:	**REMOVE FROM THE BAG:**	**ADD TO THE BAG:**
250 mL Normal Saline	50 mL	1 prefilled syringe of $D_{50}W$ (50 mL)
250 mL D_5W	25 mL	25 mL of 1 prefilled syringe of $D_{50}W$

≥ ACP(f) No Patch Required	**Thiamine (Vitamin B1)**	
	When alcoholism or malnutrition are suspected	100 mg IV (mini bag or push) or 100 mg IM

Clinical Considerations/Notes:

- Not applicable

Hyperkalemia

Indications:

- Patient exhibiting signs and symptoms of hyperkalemia

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(L) / No patch required	**Normal Saline or Ringers Lactate**
	10 mL/kg IV/IO bolus Target MAP > 65

≥ ACP(L)* / Initiate Then Patch	**Calcium Gluconate (10%)**
	20 mg/kg IV/IO (Max single dose 1g) - q 5 minutes PRN Max TOTAL dose 40 mg/kg or 2g (lesser of) Administer over 2-3 minutes Additional doses may be required, discuss with TMP

OR - if patient in cardiac arrest/pre-arrest

≥ ACP(f)* / Initiate Then Patch	**Calcium Chloride (Calcijet)**
	20 mg/kg IV/IO q 5 minutes prn Single MAX dose 1g over 20 minutes PIV (5 minutes if central line) Total MAX dose 40 mg/kg or 2g (lesser of) Slow IVP is appropriate in the setting of cardiac arrest/pre-arrest

≥ ACP(f) / Initiatethen Patch	**Sodium Bicarbonate ($NaHCO_3$)**
	1 mEq/kg dose (typically 50 mEq) IV/IO

≥ ACP(f) / Initiate Then Patch	**Dextrose**
	25 g IV/IO - Repeat X 1 if required

≥ ACP(f) / Initiate Then Patch	**Humulin R (Insulin)**
	10 units IV/IO

≥ ACP(L) Initiate Then Patch	**Salbutamol (Ventolin) MDI (100 microgram/puff)**
	16 puffs x 2 q 5-15 minutes prn (45 seconds between each administration)

OR

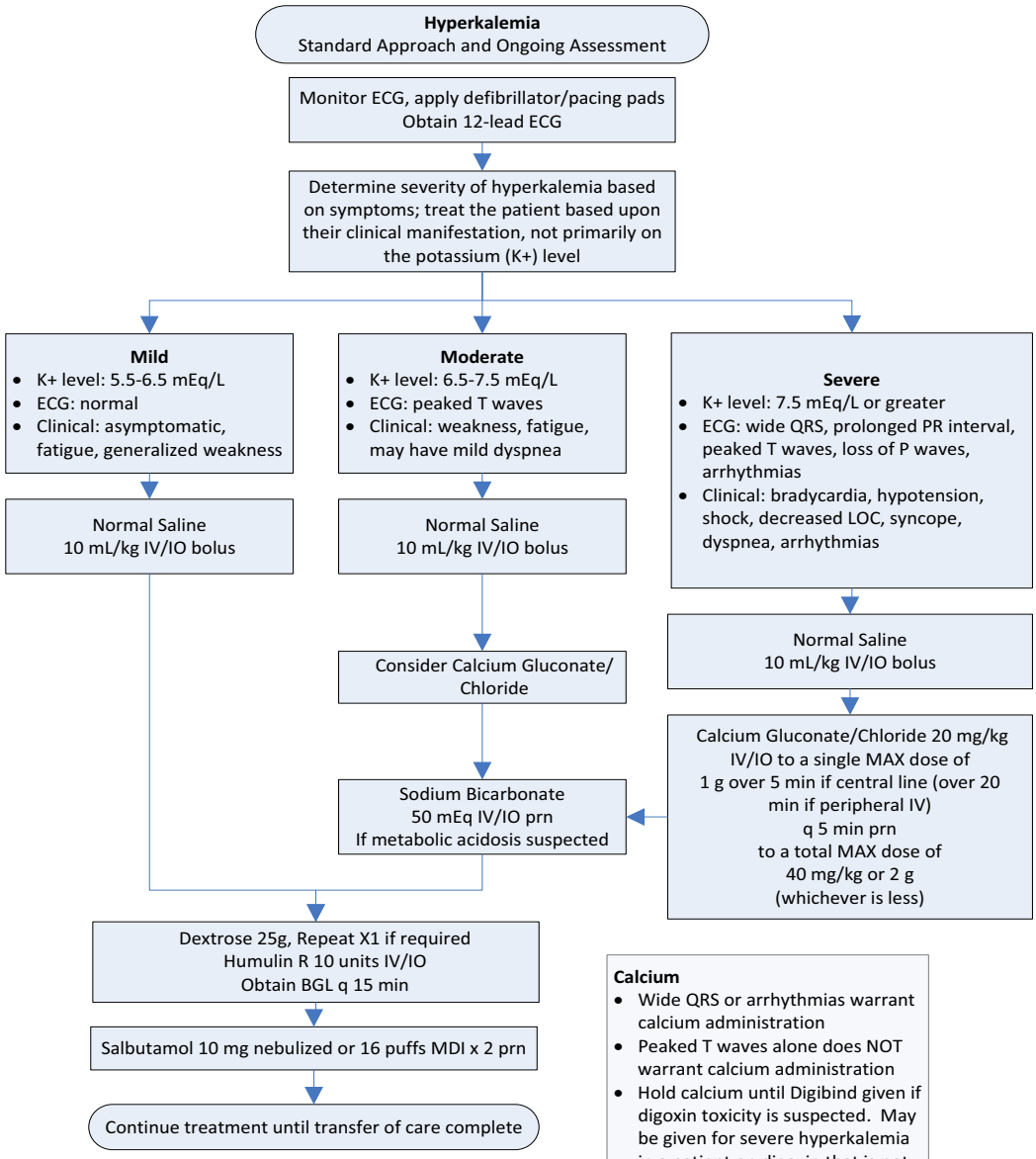
≥ ACP(L) Initiate Then Patch	**Salbutamol (Ventolin) Solution Via Nebulized Aerosol (2.5 mg/2.5 mL)**
	10 mg x 2 q 5-15 minutes prn

*Total volume of Salbutamol and Normal Saline should be 3 mL

Clinical Considerations/Notes:

- Not applicable

Hyperkalemia (continued)



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Calcium

- Wide QRS or arrhythmias warrant calcium administration
- Peaked T waves alone does NOT warrant calcium administration
- Hold calcium until Digibind given if digoxin toxicity is suspected. May be given for severe hyperkalemia in a patient on digoxin that is not suspected to be digoxin toxic

Toxicology

Suspected Acetaminophen Overdose

Indications:

- Suspected Acetaminophen toxicity

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(f) / No Patch Required	3% Mucomyst (Acetylcysteine)*			
	Dosage Guide and Preparation for IV Administration (reference CPS)			
		Initial Infusion 60 mg/kg/hr x 4 hrs	Maintenance Infusion 6 mg/kg/hr	*High Risk* Maintenance Infusion 12 mg/kg/hr
	Body Weight (kg)	Dose (ml/hr)	Dose (ml/hr)	Dose (ml/hr)
	40	80	8	16
	50	100	10	20
	60	120	12	24
	70	140	14	28
	80	160	16	32
	90	180	18	36
	100	200	20	40
	110	220	22	44
	120	240	24	48

*Please refer to Mucomyst™ (acetylcysteine) Drug Monographs profile

Clinical Considerations/Notes:

- *If local reaction or rash occurs: Stop the infusion temporarily, treat with antihistamines, ventolin prn, then restart infusion at ½ the rate
- **Mandatory Patch** required to initiate an acetylcysteine infusion
- The ACP(f), CCP and PCCP/PCCN may maintain the administration of a Mucomyst™ (acetylcysteine) infusion as per the above table for an Acetaminophen overdose **in the following circumstances:**
  - The infusion was initiated by the sending facility
  - Ingested or suspected ingestion of Acetaminophen dose is greater or equal to:
    - 10 g TOTAL
      OR
    - 200 mg/kg ideal body weight
  - The rate of infusion is in accordance with the accompanying dosage table and preparation guide
  - The rate of infusion cannot be altered by the Paramedic unless ordered by the Transport Medicine Physician

Suspected Acetaminophen Overdose (continued)

Guidelines to Prepare a 3% Intravenous *N*-Acetylcysteine Bag

As part of the Poison Centre's treatment recommendations for the acetaminophen-poisoned patient, a 3 % *n*-acetylcysteine solution will need to be prepared. The following are instructions on how to prepare this solution in **D5W**.

Patient is >40 kg

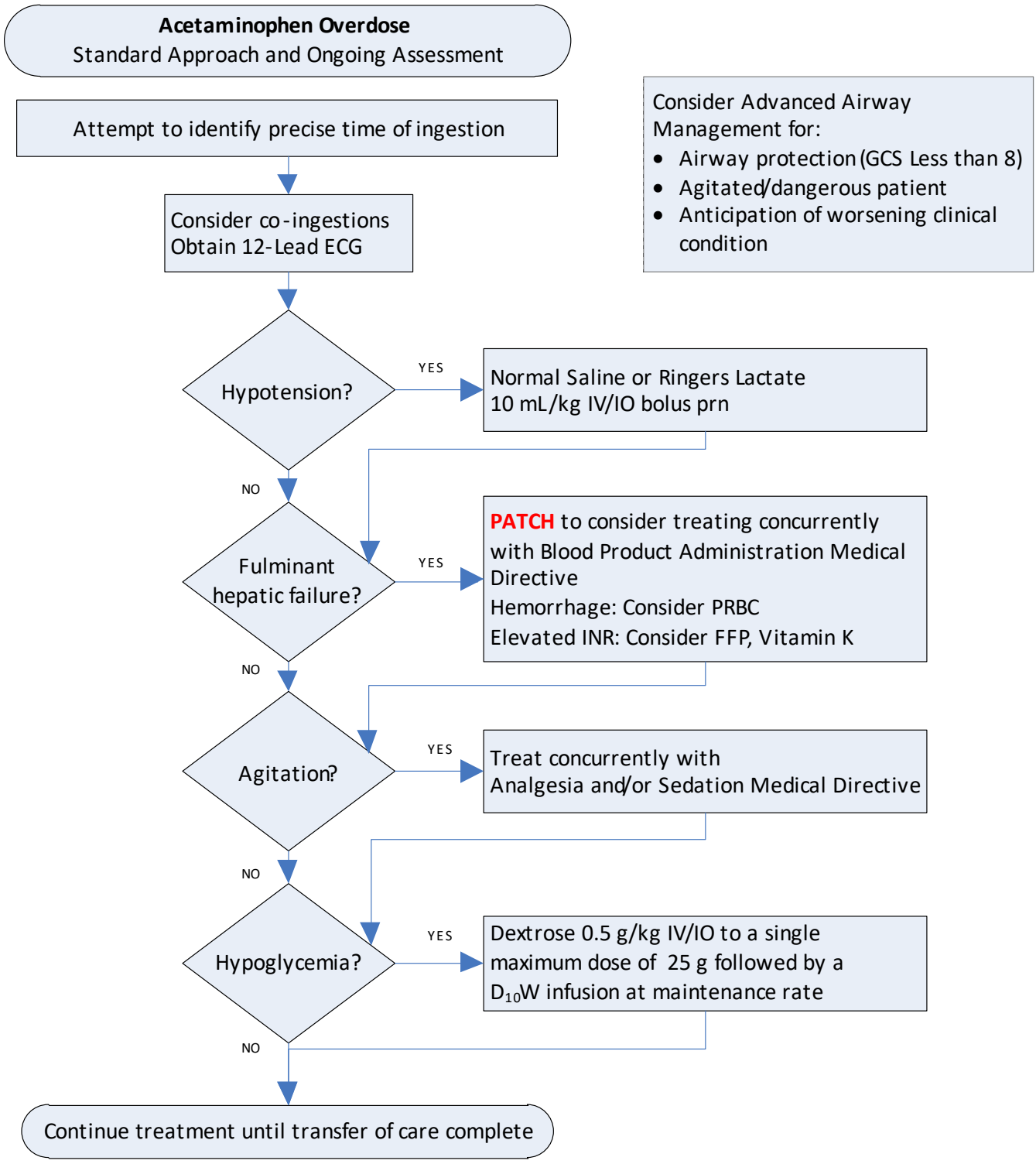
- Remove 150 ml from a 1000 ml bag of D5W
- Add 150 ml of 20% IV *N*-Acetylcysteine to the remaining 850 ml in the D5W bag
    - 150 ml X 200 mg/ml = 30 000 mg of *N*-Acetylcysteine
    - 30 000 mg in 1000 ml yields a final solution with 30 mg/ml or 3%

NOTES:

1. 20% IV *N*-Acetylcysteine is equivalent to 200 mg/ml
2. The 3% solution is slightly hyperosmolar but still within the safety margin for administration via a peripheral vein
3. It is recognized that any particular bag of IV fluid could have excessive fluid more than advertised. It is of little consequence when making this 3% solution. Assume a finished volume as advertised on the bag

Mixing is important to ensure uniform distribution of *N*-Acetylcysteine in infusion solution

Suspected Acetaminophen Overdose (continued)



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Suspected Opioid Overdose

Indications:

- GCS of < 12
  AND
- Respiratory rate < 10
  AND
- Suspected acute opioid overdose

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(L)	No patch required	**Normal Saline or Ringers Lactate**
		10-20 ml/kg IV/IO bolus Target MAP > 65

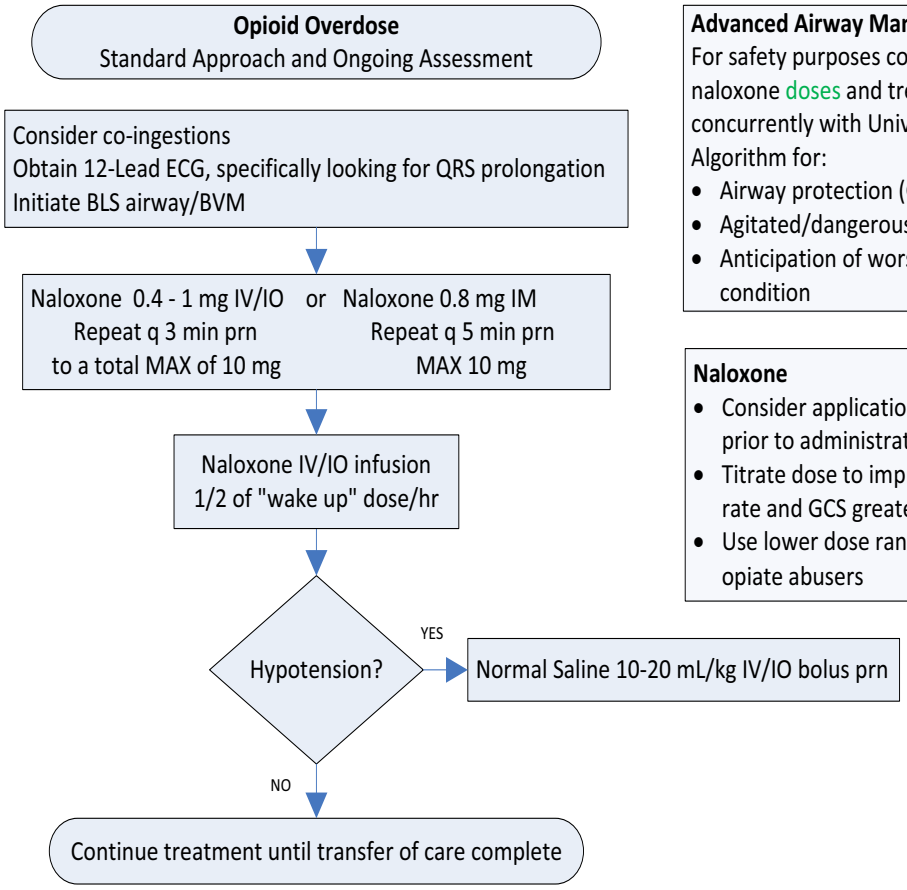
≥ PCP(f)	Initiate then Patch	**Naloxone (Narcan)**
		0.8 mg IM repeat q 5 minutes prn MAX 10 mg

≥ ACP(L)	Initiate then Patch	**Naloxone (Narcan)**
		0.4-1.0 mg slow IV, repeat q 3 minutes prn MAX 10 mg If increased LOC consider continuous IV infusion initially at ½ total waking dose per hour, titrate according to patient response

Clinical Considerations/Notes:

- Should be cautious when dealing with a suspected opioid overdose patient as naloxone (Narcan) can have dramatic effect on a chronic opioid user, causing withdrawals and possible violent behaviors

Suspected Opioid Overdose (continued)



Advanced Airway Management:
For safety purposes consider reduced naloxone doses and treating concurrently with Universal Airway Algorithm for:

- Airway protection (GCS Less than 8)
- Agitated/dangerous patient
- Anticipation of worsening clinical condition

Naloxone

- Consider applications of restraints prior to administration
- Titrate dose to improve respiratory rate and GCS greater than 8
- Use lower dose range for chronic opiate abusers

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Sedative Overdose

Indications:

- Known sedative overdose

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

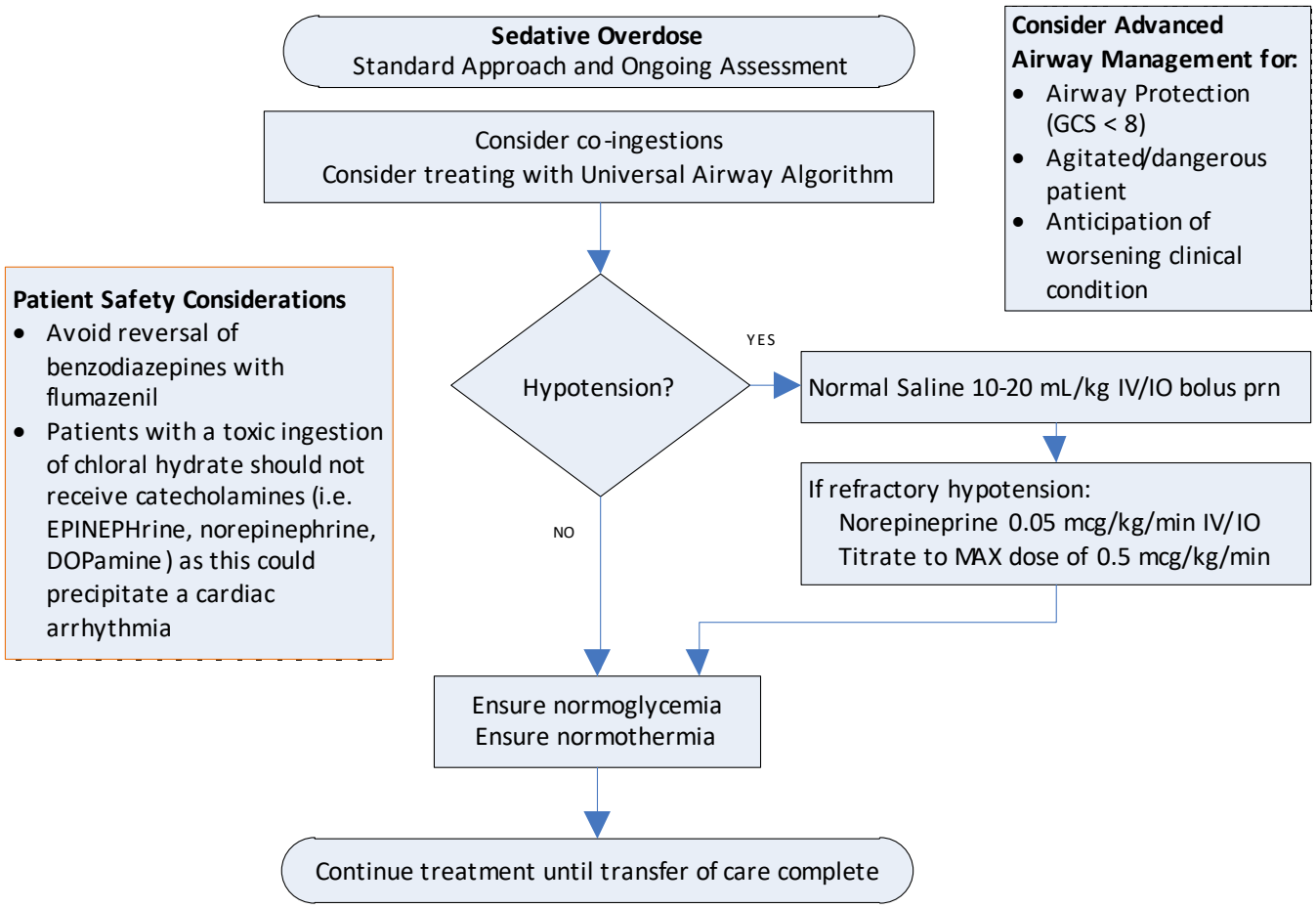
		Normal Saline or Ringers Lactate
≥ ACP(L)	No patch required	10-20 ml/kg IV/IO bolus Target MAP > 65

		Norepinephrine (Levophed)
≥ ACP(f)	Initiate Then Patch	0-0.5 microgram/kg/min IV/IO Target MAP > 65

Clinical Considerations/Notes:

- Not applicable

Sedative Overdose (continued)



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Beta Blocker Overdose

Indications:

- Known overdose to beta blocker medication

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(L) / No patch required	**Normal Saline or Ringers Lactate**
	10-20 ml/kg IV/IO bolus Target MAP > 65

≥ ACP(L) / Initiate Then Patch	**Atropine Sulfate (Atropine)**
	0.5 mg IV/IO q 3-5 minutes prn Total MAX dose 3 mg

≥ ACP(f) / Mandatory Patch	**Humulin R (Insulin)**	
	Bolus*	IV Infusion
	1 unit/kg IV/IO (followed by IV infusion)	0.5 - 2.0 units/kg/hr

*with Dextrose as below

≥ ACP(f) / Mandatory Patch	**Dextrose***
	25 g, Repeat Dextrose X 1 q 60 min PRN Obtain BGL q 15 min

*with Humulin R bolus dose as above

≥ CCP / Mandatory Patch	**Intralipid (Fat Emulsion 20%)**
	1.5 mL/kg IV/IO over 5 minutes; may repeat X 1 then 0.25 mL/kg/min infusion MAX total dose: 12 mL/kg

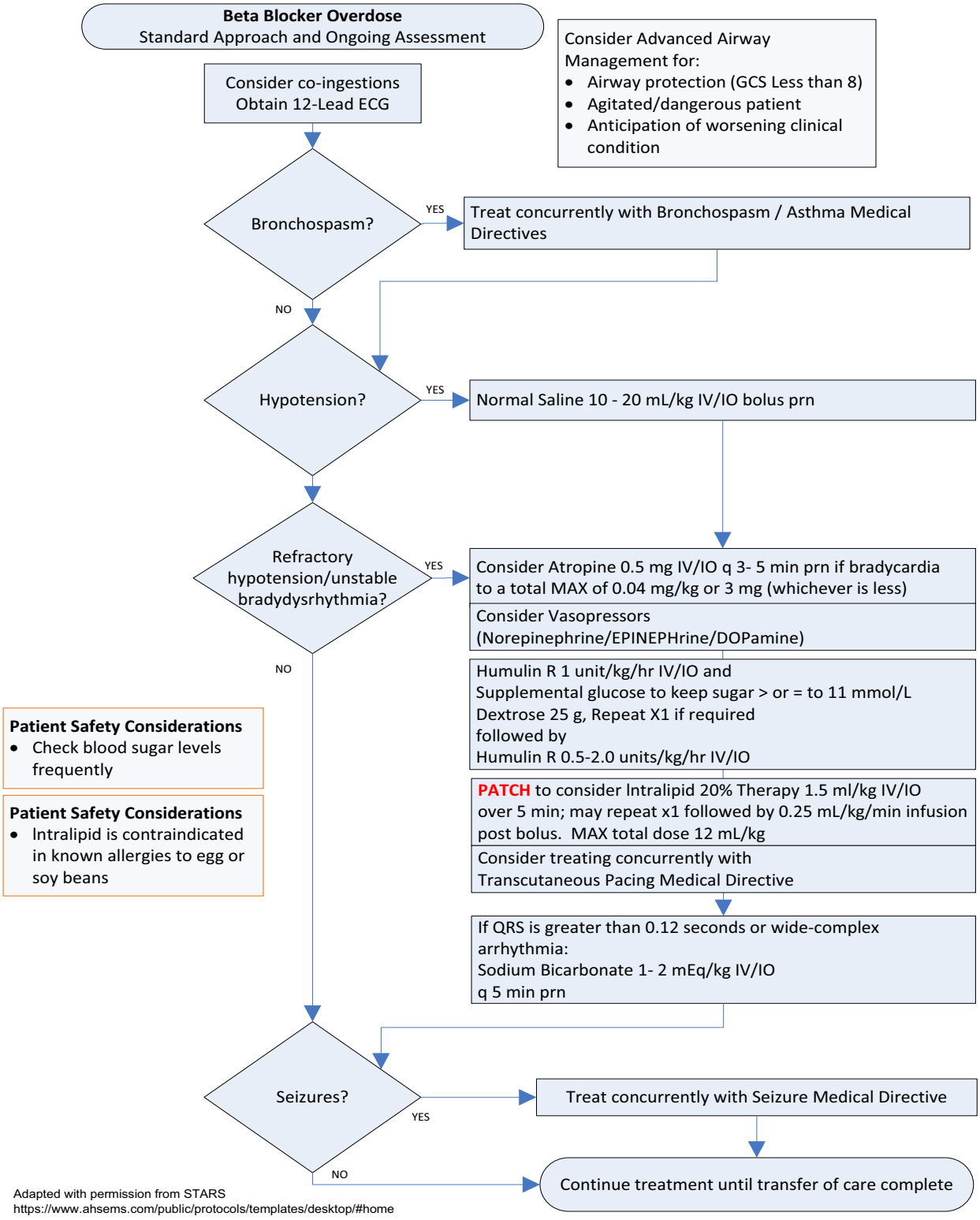
Beta Blocker Overdose (continued)

≥ ACP(f) Mandatory Patch	**Sodium Bicarbonate ($NaHCO_3$)**
	1-2 mEq/kg IV/IO q 5 minutes prn

Clinical Considerations/Notes:

- Consider Vasopressors (Norepinephrine/EPINEPHrine/DOPamine)

Beta Blocker Overdose (continued)



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Calcium Channel Blocker Overdose

Indications:

- Known overdose to calcium channel blocker medication

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(L) / No patch required	**Normal Saline or Ringers Lactate**
	10-20 ml/kg IV/IO bolus Target MAP > 65

For refractory hypotension and unstable bradydysrhythmias

≥ ACP(L)* / Initiate Then Patch	**Calcium Gluconate (10%)**
	20 mg/kg (MAX 1g/10 mL) IV/IO - Repeat q 5 minutes prn MAX 100 mg/kg up to 5g

OR - if patient in cardiac arrest/pre-arrest

≥ ACP(f) / Initiate then patch	**Calcium Chloride ($CaCl_2$)**
	20 mg/kg (MAX 1 g/10 mL) IV/IO over 5 minutes if central line* (over 20 minutes if peripheral IV) Repeat q 5 minutes prn MAX 100 mg/kg up to 5 g

* Preferred route is central line

≥ ACP(L) / Initiate Then Patch	**Atropine Sulfate (Atropine)**
	0.5 mg IV/IO q 3-5 minutes prn MAX 3 mg

≥ ACP(f) / Mandatory Patch	**Humulin R (Insulin)**	
	Bolus*	IV Infusion
	1 unit/kg IV/IO (followed by IV infusion)	0.5-2.0 units/kg/hr

*with Dextrose as below

Calcium Channel Blocker Overdose (continued)

≥ ACP(f) Mandatory Patch	**Dextrose***
	25 g, Repeat Dextrose X 1 q 60 min PRN Obtain BGL q 15 min

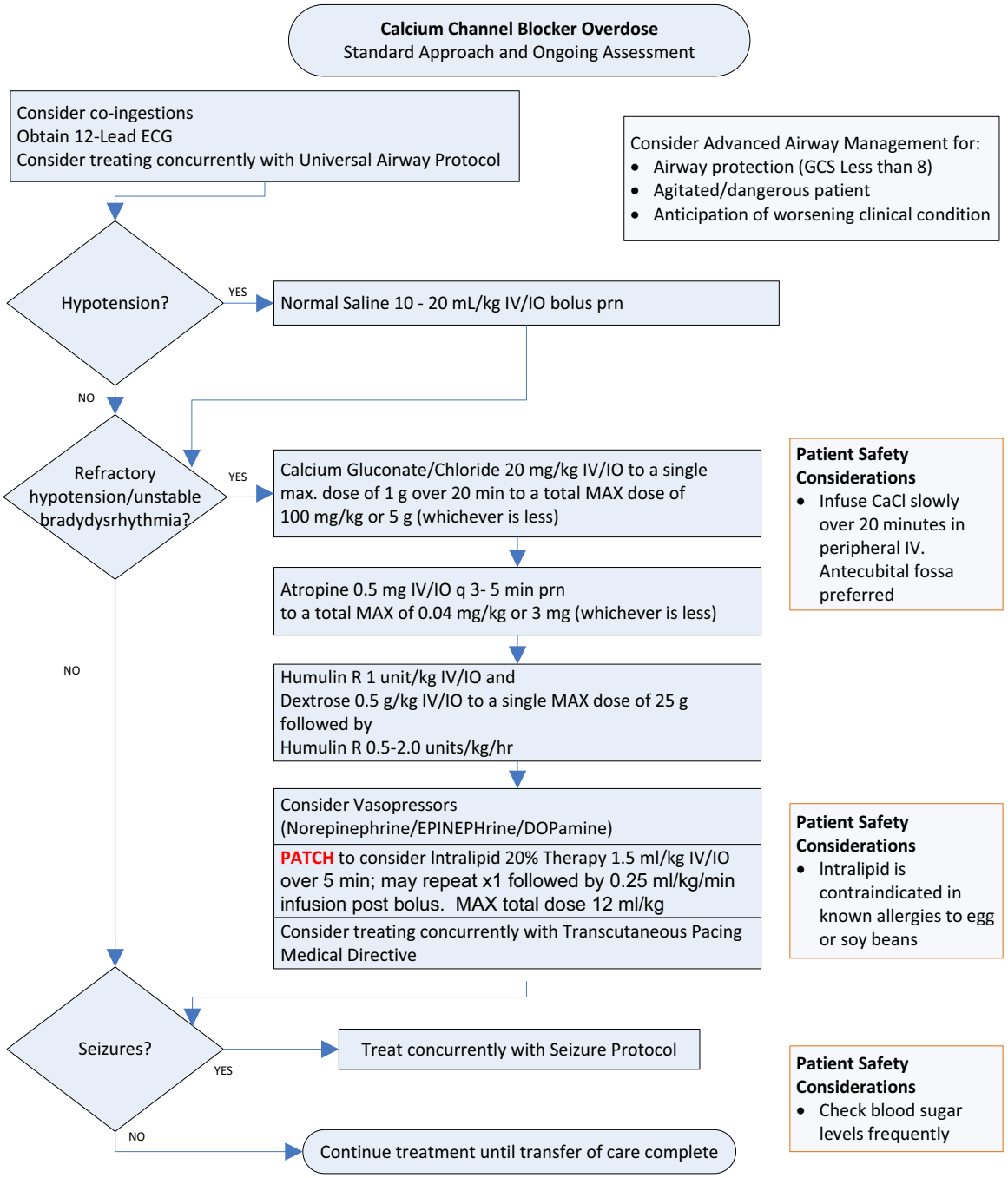
*with Humulin R bolus dose as above

≥ CCP Mandatory Patch	**Intralipid (Fat Emulsion 20%)**
	1.5 mL/kg IV/IO over 5 minutes; may repeat X 1 then 0.25 mL/kg/min infusion MAX total dose: 12 mL/kg

Clinical Considerations/Notes:

- Consider vasopressors

Calcium Channel Blocker Overdose (continued)



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Cholinesterase Inhibitor Poisoning

Indications:

- Known overdose/exposure to a cholinesterase inhibitor

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(L) / Initiate Then Patch	**Atropine Sulfate (Atropine)**
	2-5 mg IV/IO q 5 minutes prn Titrate to the drying of secretions

≥ ACP(L) / No patch required	**Normal Saline or Ringers Lactate**
	20 mL/kg IV/IO bolus Target MAP > 65

≥ ACP(f) / Initiate Then Patch	**Norepinephrine (Levophed)**
	0-0.5 microgram/kg/min IV/IO Target MAP > 65

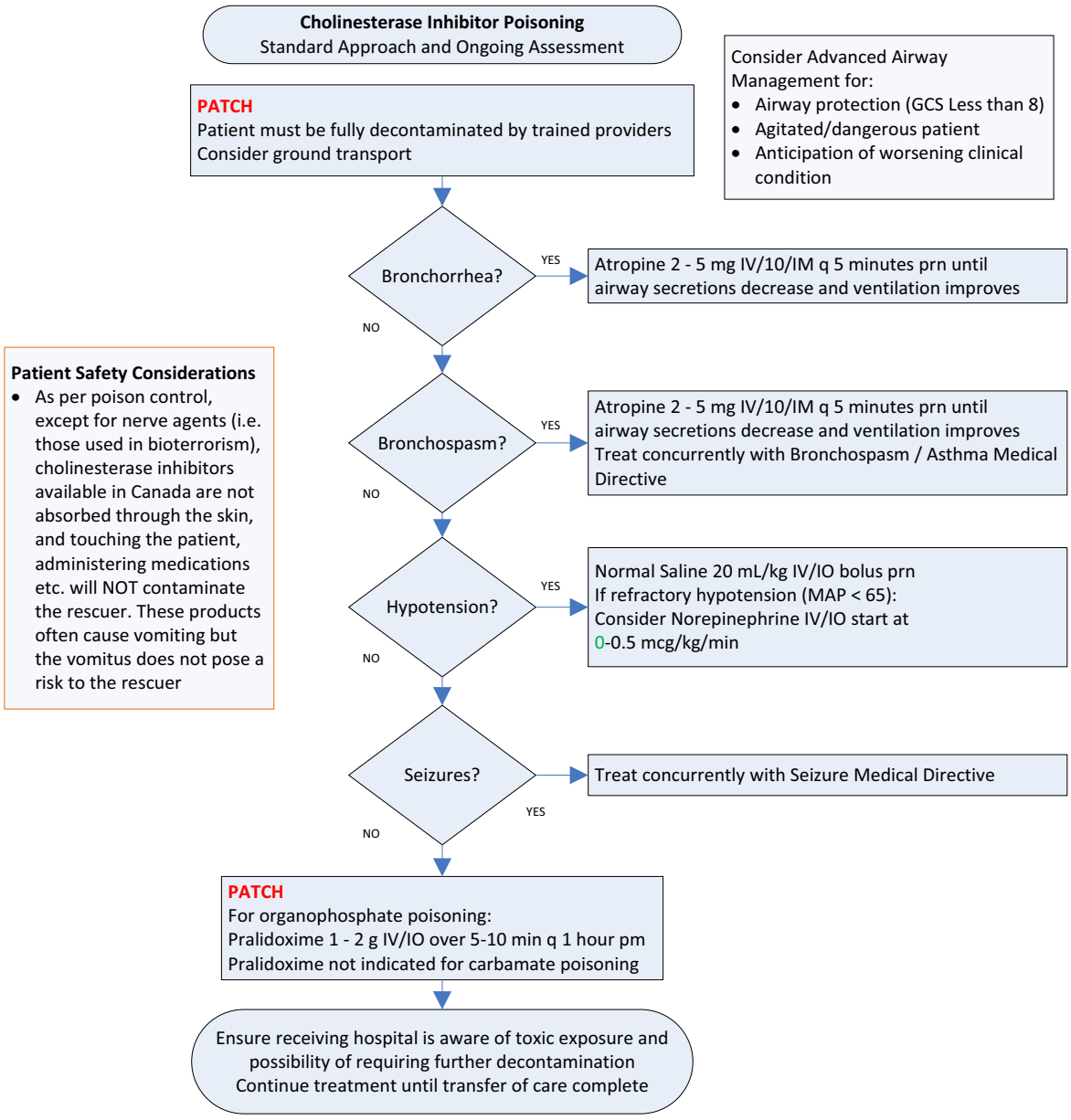
≥ ACP(f) / Mandatory Patch	**Pralidoxime* (2-PAM)**
	1-2 g IV/IO over 15-20 minutes q 1 hr prn

*Not indicated for carbamate poisoning

Clinical Considerations/Notes:

- Tachycardia is NOT a contraindication to atropine, often tachycardic due to hypoxia
- Standard PPE should be worn when treating patients with cholinesterase inhibitors unless the exposure is the result of nerve agent used in bioterrorism which require high level PPE

Cholinesterase Inhibitor Poisoning (continued)



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Cyclic Antidepressant Overdose

Indications:

- Treatment of a cyclic antidepressant overdose

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(L) / No patch required	**Normal Saline or Ringers Lactate**
	10-20 ml/kg IV/IO bolus Target MAP > 65

≥ ACP(f) / Initiate then Patch	**Sodium Bicarbonate ($NaHCO_3$)**
	1-2 mEq/kg IV/IO q 5 minutes; may repeat X 1 for MAP < 65 or wide complex tachycardia*

*Stop sodium bicarbonate boluses if QRS < 0.12 sec or pH > 7.55

≥ ACP(f) / Mandatory Patch	**Magnesium Sulfate**
	MAX 2 g IV/IO over 15 minutes for Torsades de Pointes

≥ CCP / Mandatory Patch	**Intralipid (Fat Emulsion 20%)**
	1.5 mL/kg IV/IO over 5 minutes; may repeat X 1 then 0.25 mL/kg/min infusion MAX total dose: 12 mL/kg

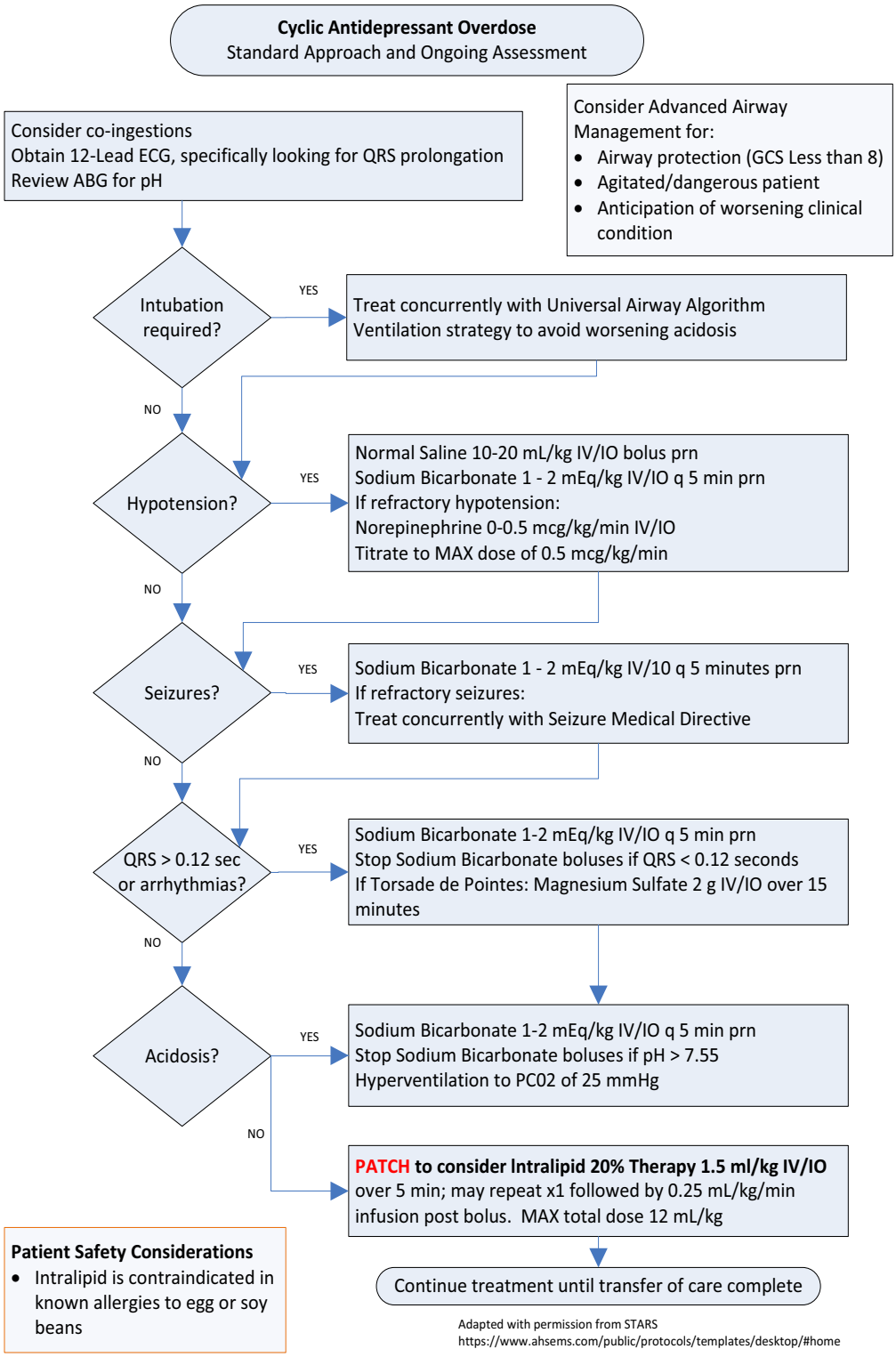
For refractory hypotension

≥ ACP(f) / Initiate Then Patch	**Norepinephrine (Levophed)**
	0-0.5 microgram/kg/min IV/IO Target MAP > 65

Clinical Considerations/Notes:

- Not applicable

Cyclic Antidepressant Overdose (continued)



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Salicylate Overdose

Indications:

- Known salicylate overdose

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(L) / No patch required	**Normal Saline or Ringers Lactate**
	10-20 ml/kg IV/IO bolus Target MAP > 65

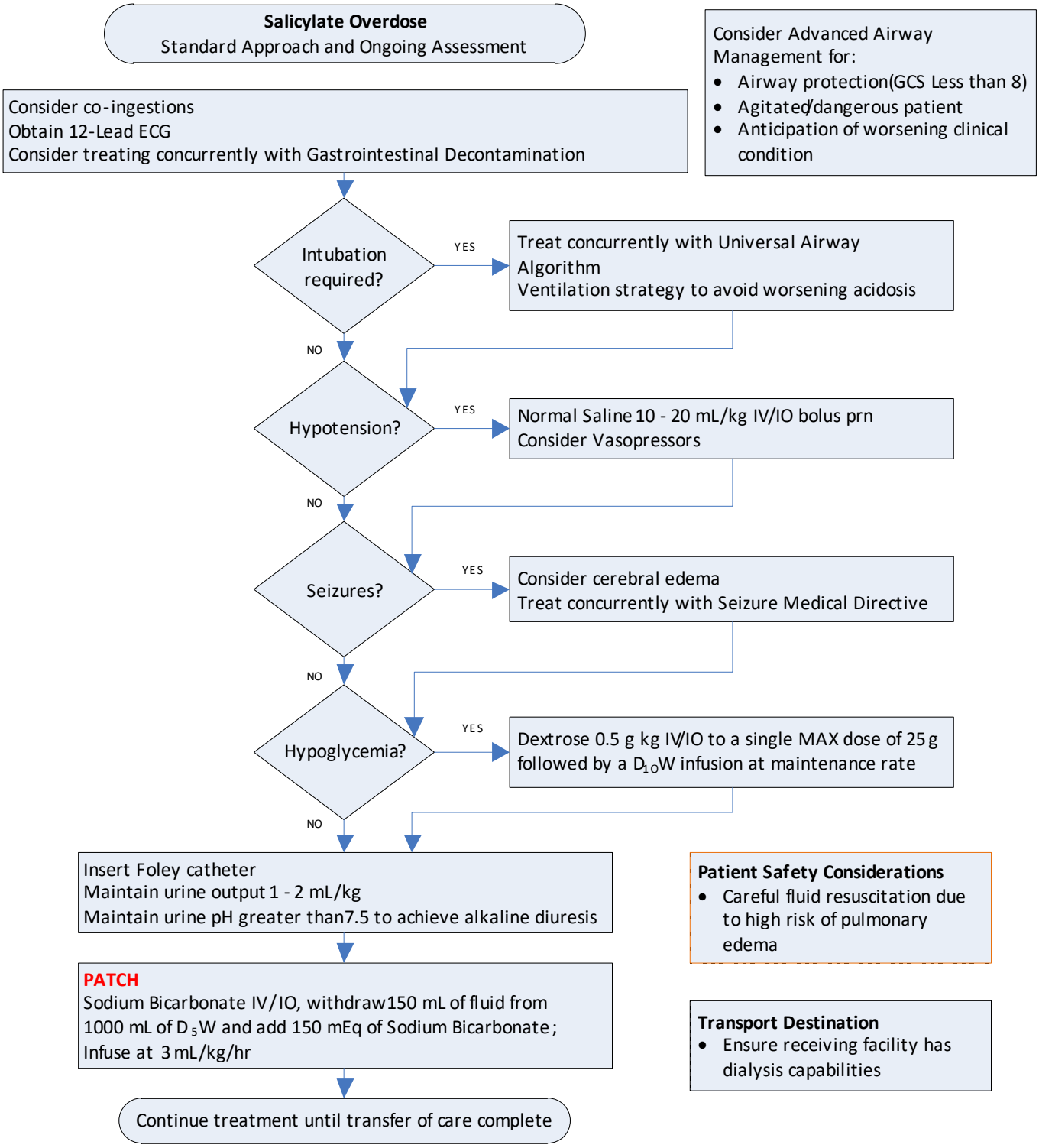
≥ ACP(f) / Mandatory Patch	**Sodium Bicarbonate ($NaHCO_3$)**	
	Bolus	Infusion
	2 mEq/kg IV/IO	3 mL/kg/hr IV/IO (Remove 150 mL of fluid from 1000 mL of D5W and add 150 mEq of Sodium Bicarbonate)

≥ ACP(L) / Mandatory Patch	**Dextrose**
	Dextrose 0.5 g/kg IV/IO to single MAX dose of 25 g followed by a $D_{10}W$ infusion at maintenance rate of 2 ml/kg/hr

Clinical Considerations/Notes:

- Not applicable

Salicylate Overdose (continued)



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Stimulant Overdose

Indications:

- Stimulant overdose

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ ACP(L) / Initiate Then Patch	**Midazolam (Versed)**
	0.05 - 0.1 mg/kg IV/IO q 5 minutes prn **MAP > 65**

≥ ACP(f) / Mandatory Patch	**Nitroglycerin (Tridil)**
	10-200 microgram/min IV/IO titrate in 5 microgram/min increments q 5 minutes to effect MAX 200 microgram/min

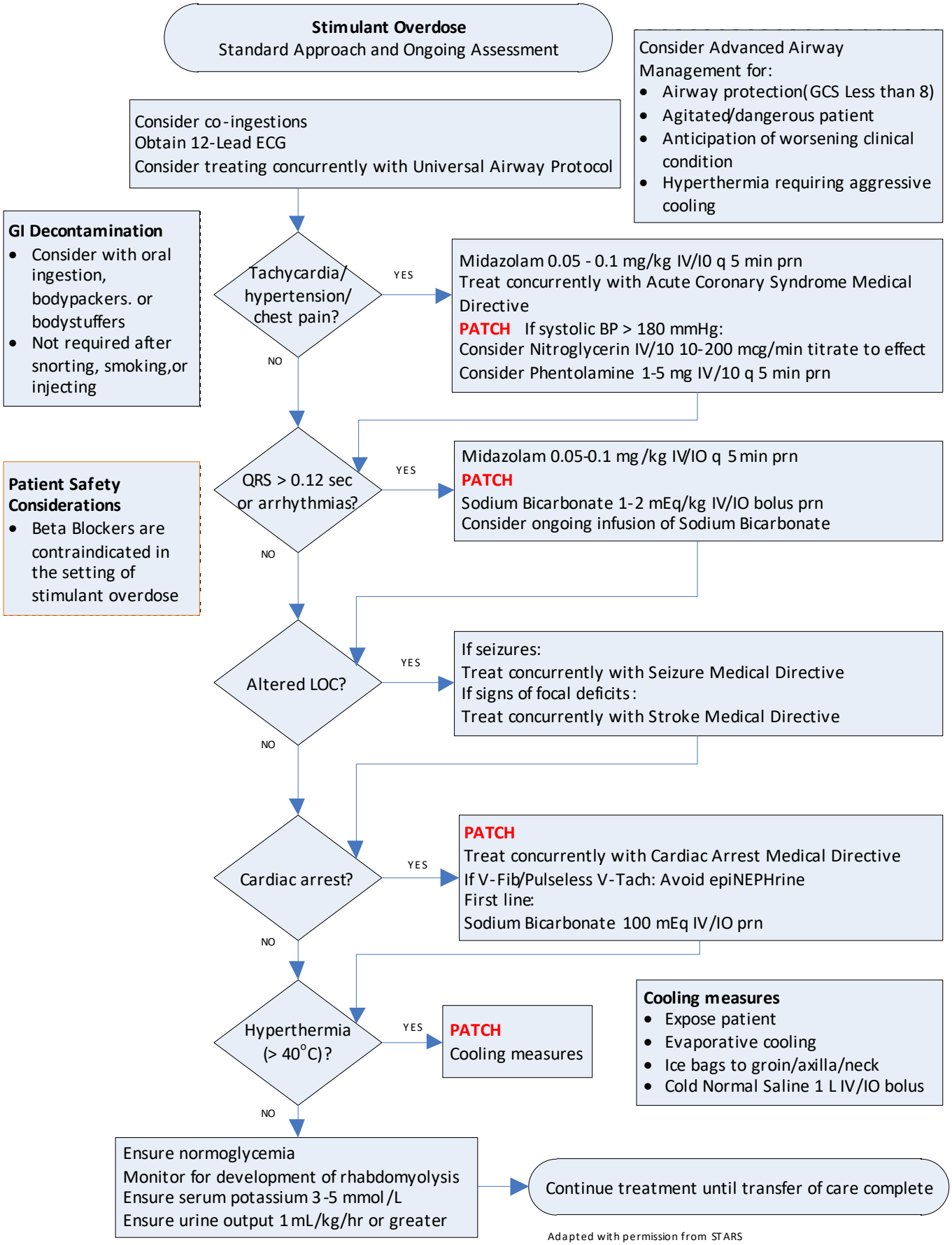
≥ ACP(f) / Mandatory Patch	**Sodium Bicarbonate ($NaHCO_3$)** For QRS > 0.12 sec or arrhythmias
	1-2 mEq/kg IV/IO bolus prn

≥ ACP(f) / Mandatory Patch	**Phentolamine**
	1-5 mg IV/IO q 5 minutes prn

Clinical Considerations/Notes:

- Not applicable

Stimulant Overdose (continued)



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Toxic Alcohol Poisoning

Indications:

- Ingestion of toxic alcohol

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

For refractory hypotension

≥ ACP(L) / No patch required	**Normal Saline or Ringers Lactate** 10-20 ml/kg IV/IO bolus Target MAP > 65

≥ ACP(f) / Initiate Then Patch	**Norepinephrine (Levophed)** 0-0.5 microgram/kg/min IV/IO Target MAP > 65

OR

≥ ACP(f) / Mandatory Patch	**Sodium Bicarbonate ($NaHCO_3$)** 1-2 mEq/kg IV/IO q 5 minutes prn

≥ ACP(f) / Mandatory Patch	**Fomepizole (Antizol)** 15 mg/kg IV/IO (to a single MAX dose of 1 g) in 100 mL Normal Saline infused over 30 minutes Repeat at 10 mg/kg IV/IO (to single MAX dose of 1 g) q 12 hours MAX dose of 55 mg/kg

≥ ACP(f) / Mandatory Patch	**Pyridoxine** 1 mg/kg IV/IO Single MAX dose of 50 mg q 6 hours

Toxic Alcohol Poisoning (continued)

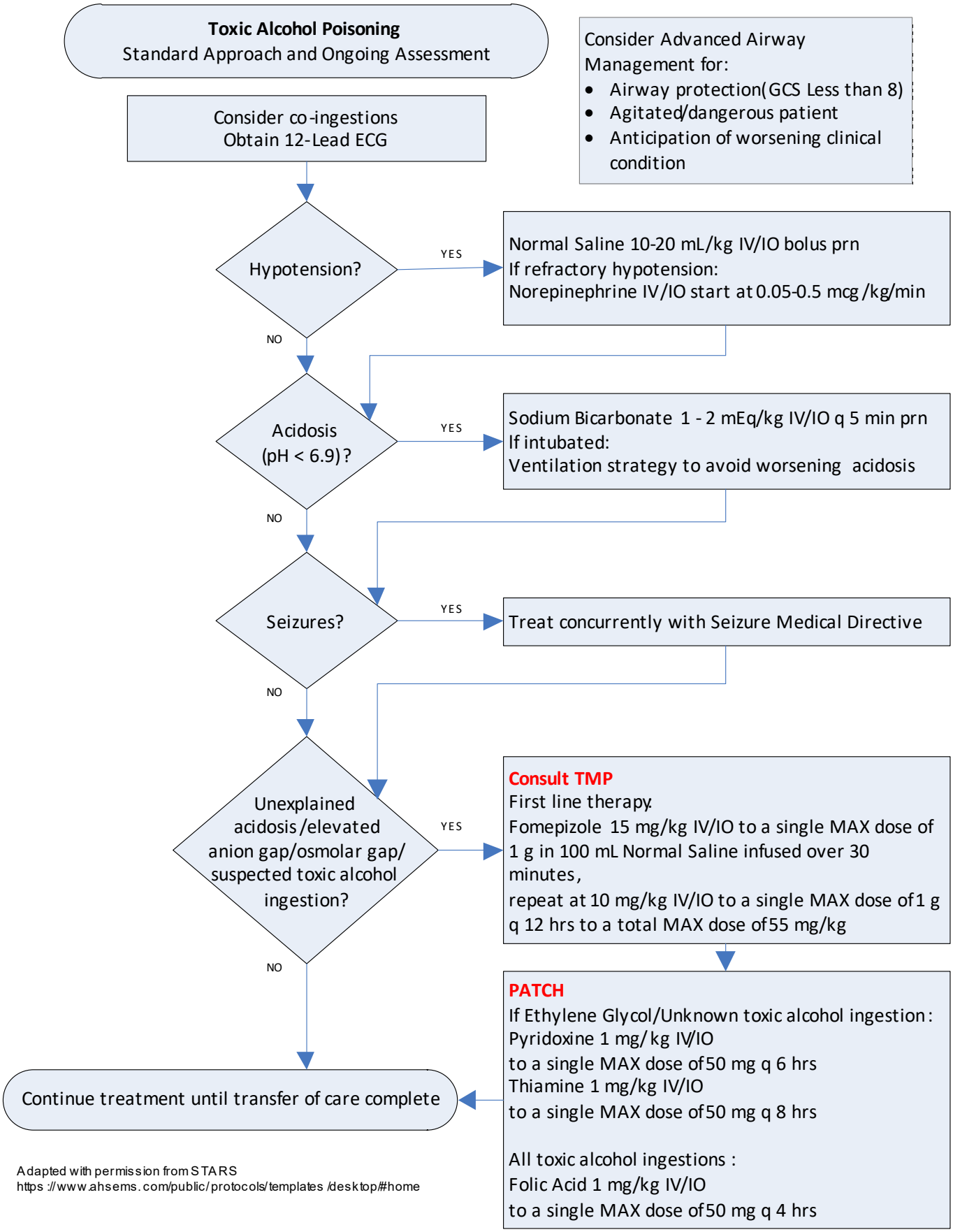
≥ ACP(f) / Mandatory Patch	**Thiamine (Vitamin B1)**
	1 mg/kg IV/IO Single MAX dose of 50 mg q 8 hours

≥ ACP(f) / Mandatory Patch	**Folic Acid**
	1 mg/kg IV/IO Single MAX dose of 50 mg q 4 hours

Clinical Considerations/Notes:

- Not applicable

Toxic Alcohol Poisoning (continued)



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Obstetrics

Obstetrical history and pertinent maternal information should be routinely documented in all pregnant patients. The history should include the following: Gravida, Para, Abortus, Estimated Gestational Age, estimated date of birth (EDB), previous deliveries/complications, Group B strep (GBS) status, if known and antibiotic treatment initiated by sending facility. If available a copy of the Ontario Perinatal Record should be included in the patient documentation for receiving facility. The FHR should be auscultated and Paramedic assessment documented and reviewed with sending staff to confirm FHR pattern with previous assessments and any changes also recorded. The receiving facility should be updated with changes in baseline FHR or any abnormal findings to ensure fetal well-being and appropriate interventions are initiated as indicated. Patients should be placed in a left lateral position by tilting or wedging the pelvis to achieve left lateral displacement of the uterus to prevent hypotension secondary to compression of the IVC.Repositioning the patient will also assist in an increase uteroplacental perfusion and alleviate cord compression. SpO2 should be monitored in all pregnant patients and supplemental oxygen should be provided to achieve SpO2 94-98%.

Premature Rupture of Membranes:

- A woman is described as having Preterm PROM or PPROM if she has ruptured membranes before 37 weeks of pregnancy but is not in established labour. Gestational age, fetal presentation, and fetal well-being should be determined in all patients with PROM
- In patients with preterm PROM, an initial period of fetal heart rate monitoring and uterine activity monitoring may help to identify abnormal fetal heart tracing and to evaluate for contractions
- Abnormal fetal heart rate tracing, clinical chorioamnionitis and abruptio placentae are clear indications for delivery emergently
- Antibiotics should be given for all patients positive for Group B Streptococcus (GBS) and considered for all patients with Premature rupture of membranes[7,8]
- Ampicillin 2 g IV q 6 hours and Erythromycin 250 mg IV q 6 hours for 48 hours should be given and followed by oral Amoxicillin 250 mg Q8H and Erythromycin 333 mg q 8 hours for 5 days for all PPROM patients less than 34 weeks gestation with no allergies to these medications. The use of Ampicillin-clavulanic acid is NOT recommended due to increased rates of necrotizing enterocolitis[4]
- For patients between 24 and less then 35 weeks gestation antenatal corticosteroids (either Betamethasone 12 mg IM every 24 hours for a total of two doses or dexamethasone 6 mg IM every 12 hours for a total of 4 doses) should be administered in women with PPROM. Repeat steroids should be given for patients < 33 weeks gestation who have not received steroids 14 days earlier and expected to deliver in the next 7 days
- Steroids should not be used to treat in the presence of diagnosed intrauterine infection. [43]
- Prophylactic tocolysis is not recommended for patients with PPROM with no signs of labor.
- Women with PPROM before 32 weeks who are thought to be at risk for imminent delivery should be treated antenatally with IV Magnesium Sulfate 4 grams followed by a Magnesium Sulfate infusion, 1 gram/ hr for 24 hours, to provide neuroprotection in preterm infantsDigital cervical examination generally should be avoided unless the patient appears to be in active labor or delivery seems imminent

Preterm Labour:

- Patients with pain or possible labour should have documentation of duration and severity of contractions, frequency of contractions, progress, cervical dilatation, and fetal fibronectin testing results if available.[9]
- Tocolytics: For patients in preterm labour, the goal is to avoid delivery during transport. Tocolytics should be strongly considered in order to minimize risk of delivery outside the hospital environment. Indomethacin 100 mg suppository followed by 25-50 mg every 6 hours for 48 hours total or niFEDIPine 10 mg orally every 4-6 hours for 48 hours or until a total of 120 mg is reached can be considered for the tocolytic.[10,11]

MagnesiumSulfate: has not been shown to be an effective tocolytic, but is advised by many high risk obstetricians for neuroprotection in preterm labour, at gestational ages less than 32 weeks. This should be discussed with the receiving obstetrician or may be continued in transport for this indication.[12-16]

Steroids: For all patients 24+0 - 34+6 weeks, documentation should include Dexamethasone/ B-Methasone given for fetal lung maturation in case of possible preterm delivery. Glucorticoids should be considered for all obstetrical patients in premature labour <35 weeks gestation.[17-19]

Patient Pre-eclampsia:

Blood pressure should be monitored every 10 minutes for all patients with pre-eclampsia or eclampsia as per BLS/ ALS provincial standards.[1] Magnesium Sulfate 4 g IV followed by 1 g IV/hr should be given for eclampsia or pre-eclampsia with severe features including Proteinuria, Platelets <100,000, a doubling of the serum creatinine, abnormal liver function tests (twice the normal limit), pulmonary edema, and cerebral or visual signs & symptoms. A recurrent seizure may require a second 2-4g bolus over 20-30 minutes. In mild cases, management should be reviewed on a case by case basis, as there is no universally accepted standard for a precise indication for starting treatment.[20-26] Benzodiazepine medications should be used for patients with ongoing seizures.[27] Antihypertensive medications such as labetalol should be given as an initial dose of 20 mg IV and repeated 20-80 mg every 30 minutes to a maximum of 300 mg. It is contraindicated in women with asthma or heart failure. NiFEDIPine 10 mg and then 10-20 mg every 45 minutes to a maximum of 50 mg. It should be swallowed and NOT chewed. HydrALAZINE 5 mg IV and repeat 5-10 mg every 30 minutes to a max of 20 mg should be considered for all ongoing hypertension.[28,29]

Hypertensive women may not tolerate large fluid volume shifts. Iatrogenic pulmonary edema is a concern because of the large amounts of intravenous fluids that may be inadvertently administered intrapartum. Intravenous and oral fluid intake should be limited in women with pre-eclampsia to avoid pulmonary edema. **The standard intravenous fluid bolus routinely administered before regional anesthesia should not be given.** The type of fluid is not as critical as the volume of fluid. Hypotension and shock may develop with lesser degrees of hemorrhage because of vascular space contraction.

Urine output is best monitored by an indwelling Foley catheter. A urine output <15 ml/hour is not unusual in pre-eclampsia, particularly postpartum. In the absence of pre-existing renal disease of a rising creatinine level, Oliguria should be tolerated at least for a few hours. The UK Confidential Enquiry into Maternal Deaths found that excess maternal mortality is associated with aggressive fluid use and not with transient renal compromise. In the presence of Oliguria, a careful assessment of volume status and renal function is indicated. When a patient is undergoing medication induction of labor and is receiving Magnesium Sulfate with oxytocin, it is prudent to limit IV fluid intake by concentrating the solutions of oxytocin and Magnesium Sulfate. Hourly total intake and urine output must be monitored closely in this situation to prevent pulmonary edema.

Fluid Mangement Recommendations in the presence of Oliguria (<15 ml/hour):

- Clinically assess volume status
- Measure renal function (creatinine)
- Beware of magnesium toxicity
- Consider a small fluid bolus (500 ml normal saline)
- Monitor O_2 saturation (keep 94-98%)
- Beware of pulmonary edema
- Consider consultation, of Oliguria persists and creatinine is rising

Dopamine or furosemide should be administered in the presence of persistent Oliguria occuring before delivery

Patient Post-Partum Hemorrhage:

Uterine massage should be attempted for patients with persistent postpartum hemorrhage.[30] Use of oxytocin should be systematic in cases of postpartum hemorrhage.[31-33] Ergonovine is contraindicated in hypertension. The dose is 0.2-0.25 mg IV/IM every 2 hours and carboprost/hemabate should be given 250 mcg IM in intramyometrially every 15 minutes to a max of 8 doses for refractory postpartum hemorrhage.[34-37]

Patient with Birth / Delivery:

Oxytocin should be given routinely as per current guidelines for delivery.[38,31] APGAR scores should be documented for all births.[39]

Obstetrical Transfer Preparation

1. The Paramedic ensures the patient is gowned appropriately for transport. An incontinence pad is used in preparation for imminent delivery
2. If the patient is in active labour (contractions 5 minutes apart), the patient should have one initial visual perineal examination completed and the findings documented. No digital vaginal or rectal examination is to be done to determine cervical dilatation or for any other concerns. The sending MD or RN should be asked to perform a cervical exam if not done within 1 hour of departure
3. The following should be obtained:
    - Fetal heart rate (intermittent assessment throughout transport must be completed)
    - Expected date of birth (EDB)
    - Duration of contractions (from beginning to end of one contraction)
    - Frequency of contractions (from beginning of one contraction to the beginning of the next contraction)
    - Para and gravida status
    - A complete set of mother's vital signs, repeated q 15 minutes
    - Cervical dilatation
4. Medical escorts are determined by the sending physician, TMP and paramedics
5. Maintain SpO2 94-98%
6. The mother is encouraged to lie on her left side or have a pillow placed under her right buttock to prevent supine hypotension syndrome
7. The ACP(f), CCP and PCCP/PCCN must ensure that all obstetrical patients in active labour have peripheral intravenous access (normal saline TKVO or saline lock)
8. Contraindications to transport include: inability to stabilize mother, suspected acute fetal compromise, delivery is imminent, weather conditions are too hazardous for travel.

Pre-Term Obstetrical Complications

Indications:

- Patients at high risk of preterm birth

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

Tocylitics

≥ ACP(f) / Mandatory Patch	Indomethacin (<30 weeks only)
	100 mg PR followed by 25-50 mg every 6 hours for 48 hours max

OR

≥ ACP(f) / Mandatory Patch	niFEDIPine (Adalat) *Contraindicated with MAP < 70* *Tablets should not be crushed*		
	20 mg PO	Initial dose of 10-20 mg PO, then 10 mg PO q 20 minutes if contractions persist to MAX dose of 40 mg in the first hour of treatment	May continue treatment of 10-20 mg q 4h if contractions persist to MAX dose of 120 mg/day

Other

≥ ACP(f) / Mandatory Patch	Glucocorticoids	
	Dexamethasone	**Betamethasone**
	6 mg IM q 12 hours x 4 if 24 - < 35 weeks	12 mg IM q 24 hours x 2 if 24 - < 35 weeks

Clinical Considerations

- Antenatal glucocorticoid therapy may be administered between 35+0 to 36 + 6 weeks gestation in select clinical situations in discussion with Obstetrician

≥ ACP(f) / Mandatory Patch	Antibiotics		
	Ampicillin 2 g IV q 6 hours	**and**	Erythromycin 250 mg IV q 6 hours for 48 hours

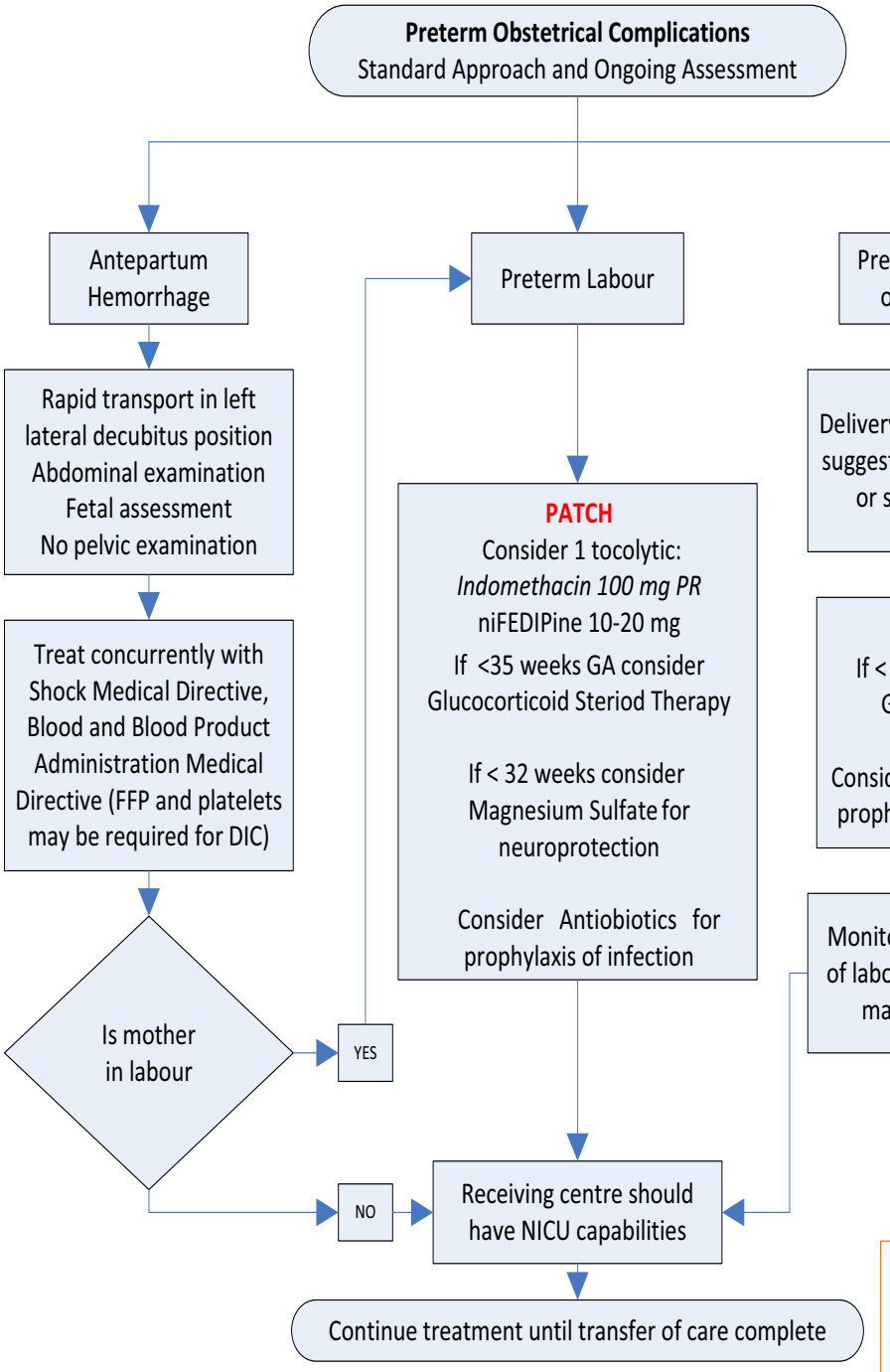
Pre-Term Obstetrical Complications (continued)

≥ ACP(f) / Mandatory Patch	**Magnesium Sulfate ($MgSO_4$)**
	IV loading dose of 4 g: (over 27 minutes or 150 mg/min MAX) Maintenance infusion: 1 g/hr • Dose should not exceed 30-40 g/24 hours or 20 g/48 hours in renal insufficiency • Dilute to a ≤ 20% solution for IV infusion

Clinical Considerations/Notes:

- Use caution in administering a tocolytic to someone with an antepartum hemorrhage

Pre-Term Obstetrical Complications (continued)



Patient Safety Considerations
Use caution in administering a tocolytic to someone with an antepartum hemorrhage

Patient Safety Considerations
In general, transport should not be initiated with patients with cervical dilation greater than 4-6 cm; however, the transport decision is based on labour progression, parity, obstetrical and delivery history, gestational age and transport time

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Pre-eclampsia / Eclampsia

Indications:

- Symptoms of pre-eclampsia/eclampsia and pregnant or post—partum within 28 days
- Pre-eclampsia with severe features is defined as including Proteinuria, Platelets <100,000, a doubling of the serum creatinine, LFT 2x normal, pulmonary edema, or cerebral or visual symptoms

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

If, on assessment, a patient is determined to be having a seizure, management of airway, breathing and circulation remain the first priority: adequate oxygenation and ventilation must be ensured.

For severe signs and symptoms of pre-eclampsia

≥ ACP(f) / Mandatory Patch	**Magnesium Sulfate ($MgSO_4$)**
	IV loading dose of 4 g: (over 27 minutes or 150 mg/min MAX) Maintenance infusion: 1 g/hr • Dose should not exceed 30-40 g/24 hours or 20 g/48 hours in renal insufficiency • Dilute to a ≤ 20% solution for IV infusion

Labetalol or Hydralazine

≥ ACP(f) / Mandatory Patch	**Labetalol (Trandate)**
	10-20 mg IV/IO q 20 minutes prn OR 1-2 mg/min infusion

OR

≥ CCP / Mandatory Patch	**Hydralazine (Apresoline)**
	Hydralazine 5-10 mg IV/IO over 2 minutes q 20 minutes prn

For Seizures

≥ ACP(f) / Initiate then Patch	**Magnesium Sulfate (MgSO4)***
	IV loading dose of 4 g (over 27 minutes or 150 mg/min MAX) followed by maintenance infusion of 1 g/hr; dose should not exceed 30-40 g/24 hours or 20 g/48 hours in renal insufficiency Dilute to a ≤ 20% solution for IV infusion

*First-line medication for treatment of seizures as well as prophylaxis after eclampsia

Pre-eclampsia / Eclampsia (continued)

≥ ACP(L) Initiate Then Patch	**Midazolam (Versed)**
	5 mg IV doses repeated every 5 minutes, until seizure termination or MAX dose of 0.2 mg/kg IV in total **or** 10 mg IM if no IV access

For treatment of Magnesium Toxicity

≥ ACP(f)* Initiate Then Patch	**Calcium Gluconate (10%)**
	20 mg/kg IV/IO (Max single dose 1g) - q 5 minutes PRN Max TOTAL dose 40 mg/kg or 2g (lesser of) Administer over 2-3 minutes Additional doses may be required, discuss with TMP

OR - if patient in cardiac arrest/pre-arrest

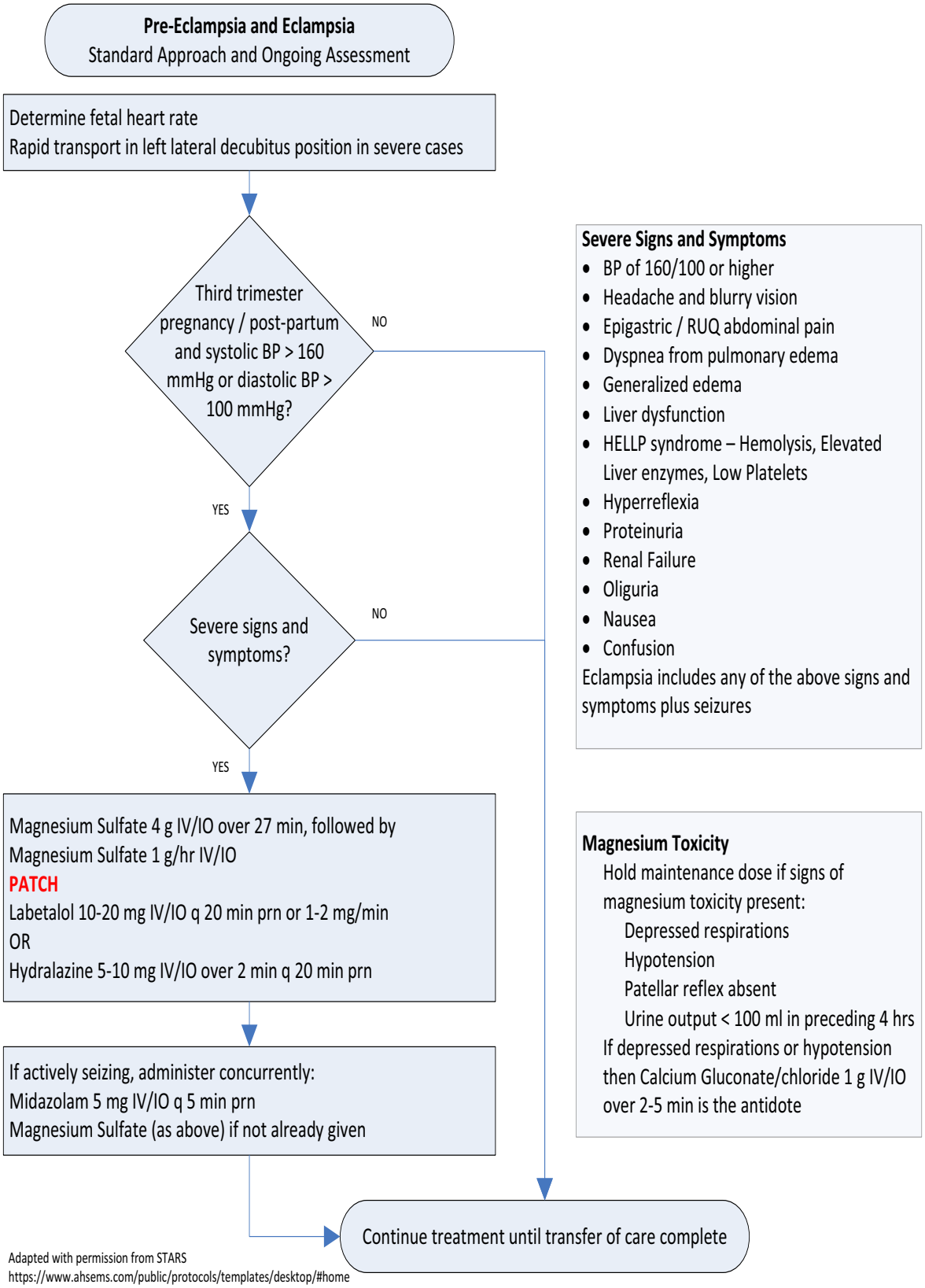
≥ ACP(f)* Initiate Then Patch	**Calcium Chloride (Calcijet)**
	20 mg/kg IV/IO q 5 minutes prn Single MAX dose 1g over 20 minutes PIV (5 minutes if central line) Total MAX dose 40 mg/kg or 2g (lesser of) Slow IVP is appropriate in the setting of cardiac arrest/pre-arrest

*** Preferred route central line or antecubital fossa IV**

Clinical Considerations/Notes:

- Eclamptic seizures are almost always self-limiting and seldom last longer than three to four minutes (usual duration 60 to 75 seconds). Magnesium loading dose is used to prevent recurrent seizures
- The magnesium dosage regimen should not cause toxicity in normal renal function
- In event of magnesium toxicity (i.e. respiratory depression/paralysis, severe hypotension) give calcium chloride
- Magnesium sulphate is recommended as prophylaxis against eclampsia in women with severe pre-eclampsia
- Routine monitoring of serum magnesium levels is not recommended
- Phenytoin and benzodiazepines should not be used for eclampsia prophylaxis or treatment, unless there is a contraindication to magnesium sulphate or it is ineffective

Pre-eclampsia / Eclampsia (continued)



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Labour and Delivery - Emergency Birth

Indications:

- Complicated delivery

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ PCP(f) – Initiate then Patch	**Treat per the appropriate algorithm for Normal Delivery or Delivery Complications** **Consider:** External uterine massage Gaskin maneuvre H.E.L.P.E.R. maneuvers (shoulder dystocia) Mariceau-Smellie-Veit maneuver (Breech) McRoberts maneuver Umbilical cord management

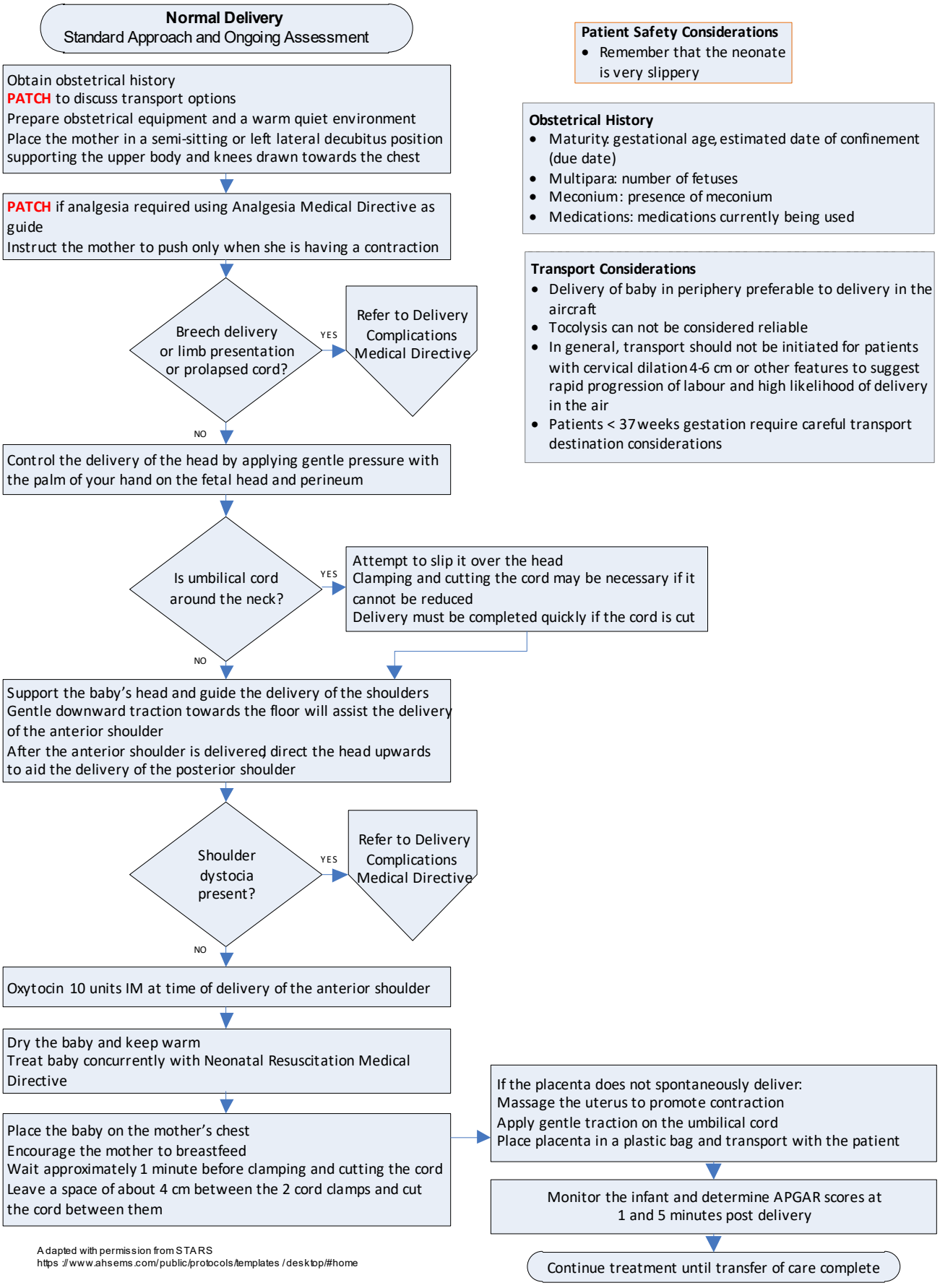
≥ CCP – Initiate then Patch	**Reverting Uterine Inversion**

≥ ACP(f) – Initiate then Patch	**Oxytocin (Syntocin)**
	10 units IM with anterior shoulder

Clinical Considerations/Notes:

- Not applicable

Labour and Delivery - Normal Delivery



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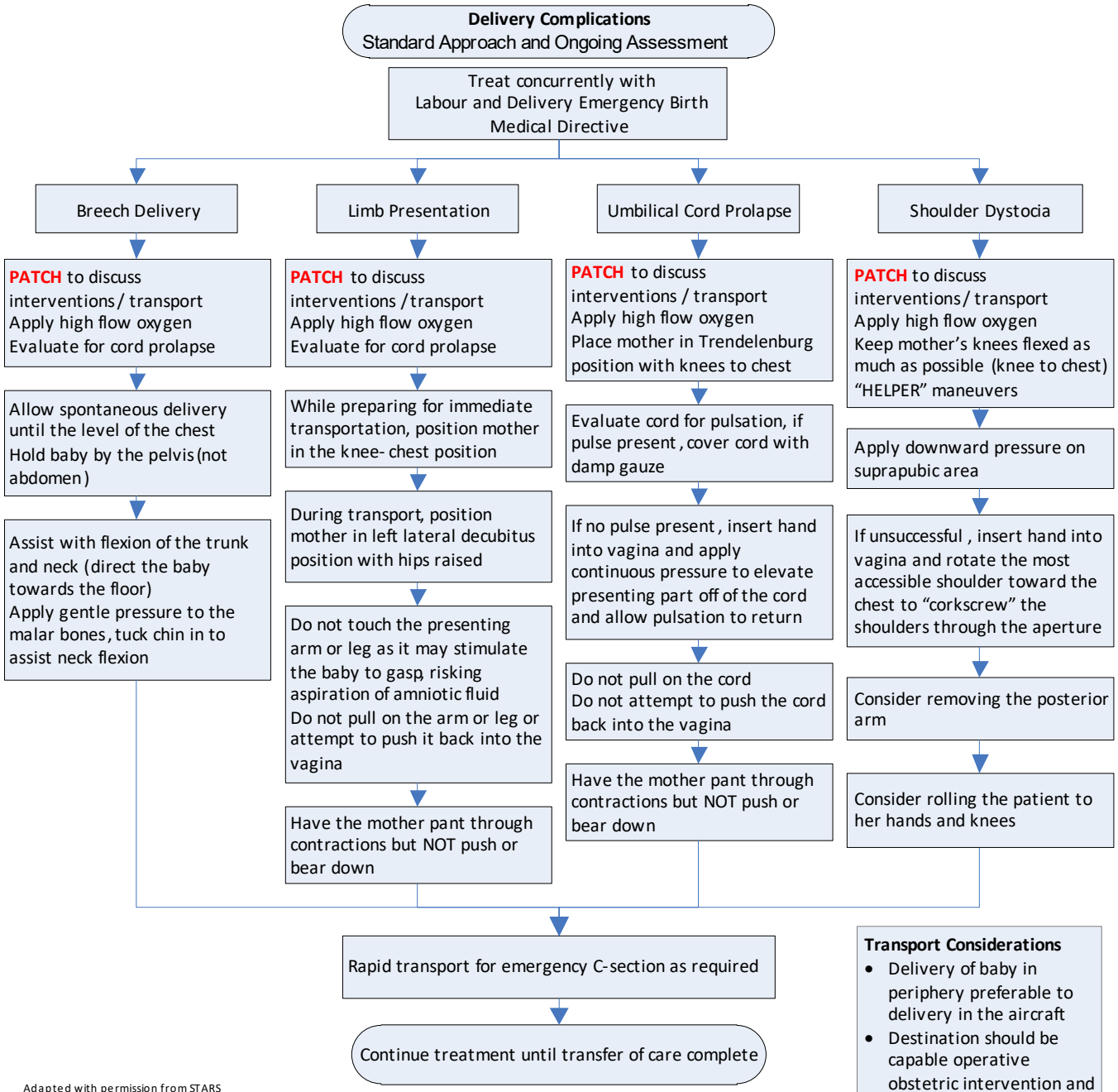
Labour and Delivery - Delivery Complications



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Post Emergency Birth

Indications:

- Following an emergency birth

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

	Oxytocin (Syntocin)
≥ ACP(f) Initiate then Patch	Additional 10 units IM after delivery of the placenta AND 40 units in 1000 mL NS at 2.5 units/hr (62.5 mL/hr) if bleeding minimal

Clinical Considerations/Notes:

- Notify the receiving facility ASAP
- **DO NOT** administer oxytocin by IV push
- **For postpartum hemorrhage (PPH)** consider differential diagnosis and additional pharmacologic therapies (i.e. Ergonovine, Hemabate)

Post-Partum Hemorrhage

Indications:

- Post-Partum Hemorrhage

Contraindications:

- Allergy or sensitivity to the medication
- Ergonovine is contraindicated in presence of hypertension

Treatment:

≥ PCP(f) / No Patch Required	**External Uterine Massage**

≥ ACP(f) / Initiate then Patch	**Oxytocin (Syntocinon)**
	10 units IM with anterior shoulder and + 10 units IM after delivery of the placenta AND 40 units in 1000 mL of Normal Saline at 10units/hr (250 mL/hr)

≥ CCP / Initiate then Patch	**Brandt Manoeuvre** Apply firm traction to the (clamped) umbilical cord with one hand while the other applies suprapubic counter pressure to deliver the placenta

≥ CCP / Mandatory Patch	**Ergonovine (Ergometrine)***
	0.2 mg IV or IM q 2 to 4 hours max 1 mg (total of 5 doses)

*Should not be used prior to delivery of the placenta

≥ CCP / Mandatory Patch	**Hemabate (Carboprost Tromethamine)**
	250 microgram (1 ml) IM Dosage may be repeated at 15-90 minute intervals until therapeutic response or to a max cumulative dose of 2 mg (8 doses)

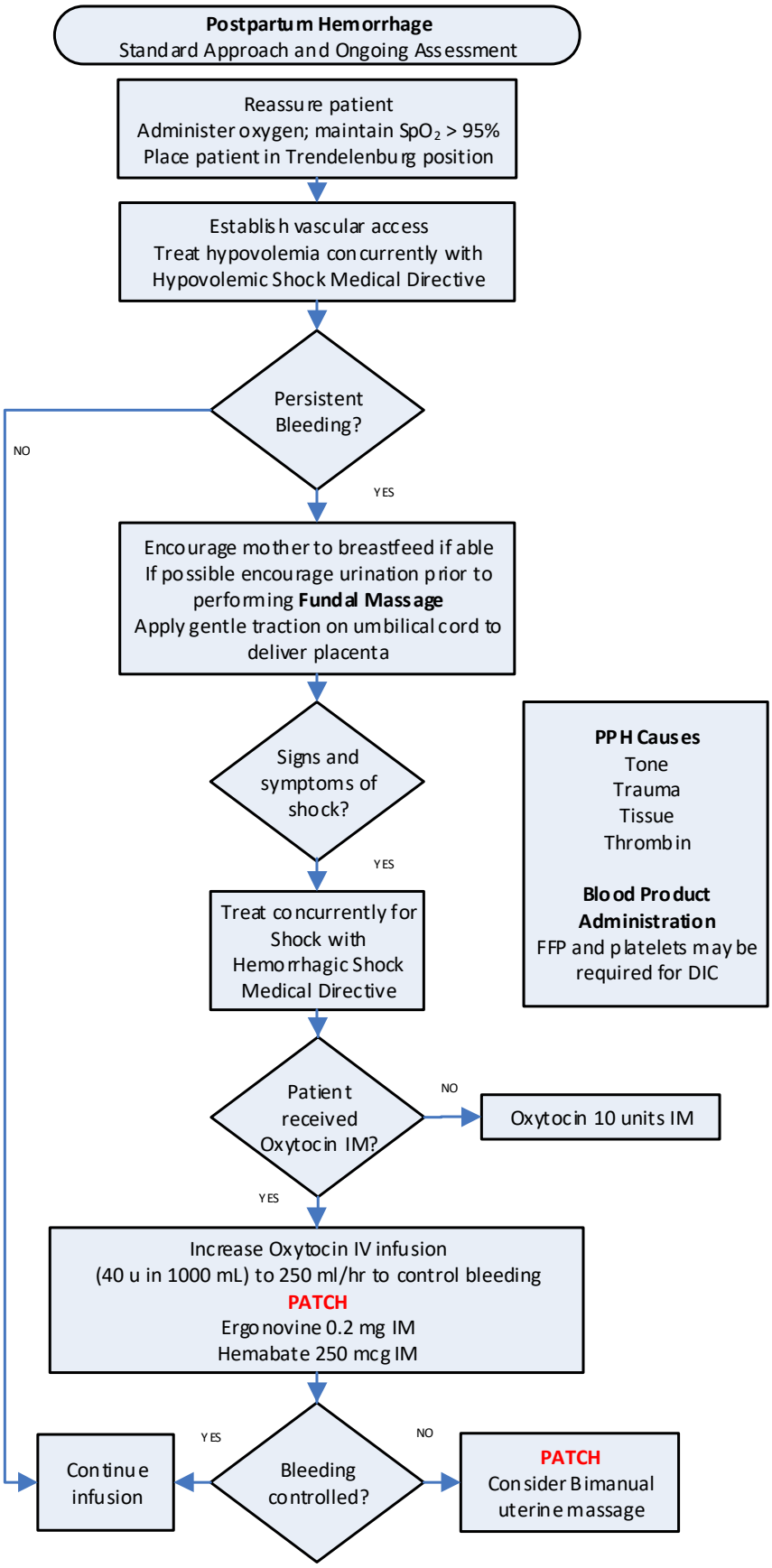
CCP / Initiate then Patch	**Bimanual Uterine Massage**

Post-Partum Hemorrhage (continued)

Clinical Considerations/Notes:

- Not applicable

Post-Partum Hemorrhage (continued)



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https://www.ahsems.com/public/protocols/templates/desktop/#home

Advanced Active Management of the Third Stage

Indications:

- In the event the placenta is not delivered within 15 minutes of delivery of the neonate
  OR
- If there is life threatening post-partum hemorrhage

Contraindications:

- Allergy or sensitivity to the medication

Treatment:

≥ CCP	Initiate then Patch	**Brandt Manoeuvre** Apply firm traction to the (clamped) umbilical cord with one hand while the other applies suprapubic counter pressure to deliver the placenta

Clinical Considerations/Notes:

- Oxytocin 10 units IM immediately after delivery of baby
- Delayed cord clamping should occur at least 30 seconds after birth unless the baby requires resuscitation. Further advanced measures for active management of the third stage may be done by the CCP and PCCP/ PCCN who has been trained, via contact with the TMP or either prospective or retrospective orders if contact with the TMP is impossible or cannot be obtained quickly

Mixing Tables

Adult Mixing and Administration Table for Continuous Infusion Summary

Adult Mixing and Administration Table for Continuous Infusion Summary

Drug	Drug to Add to Diluent	Diluent (mL)	BD Library Dose Range	Standard Concentration
Amiodarone [Use 0.22 micron In-line filter]	450 mg	250 mL D_5W	0.01 - 1 mg/min	1.8 mg/mL
Cisatracurium	40 mg	100 mL D_5W/NS	1 - 10 mcg/kg/min	0.4 mg/mL
dilTIAZem	100 mg	100 mL D_5W/NS	2.5 - 15 mg/hr	1 mg/mL
DOBUTamine	250 mg	250 mL D_5W/NS	0.01 - 30 mcg/kg/min	1000 mcg/mL
DOPamine	N/A (premixed)	200 mg/250 mL premixed D5W 400 mg/250 mL premixed D5W 800 mg/250 mL premixed D5W	0.01 - 30 mcg/kg/min	800 mcg/mL 1600 mcg/mL 3200 mcg/mL
EPINEPHrine	4 mg	250 mL D_5W/NS	0.01 - 1.0 mcg/kg/min	16 mcg/mL
Esmolol	N/A premixed	2500 mg/250 mL premixed	50 - 300 mcg/kg/min	10 mg/mL
FentaNYL	500 mcg	50 mL D_5W/NS	0.01 - 5 mcg/kg/hr	10 mcg/mL
Heparin	25,000 units	500 ml D_5W	400 - 3000 units/hr	50 units/mL
HydrALAZINE	50 mg	250 mL NS	0.01 - 5 mcg/kg/min	200 mcg/mL
Insulin	100 units	100 mL NS	0.01 - 2 units/kg/hr	1 unit/mL
Isoproterenol	1000 mcg	250 mL D_5W/NS	0.01 - 20 mcg/min	4 mcg/mL
Ketamine	500 mg	50 mL D_5W/NS	0.01 - 4.5 mg/kg/hr	10 mg/mL
Labetalol	250 mg	50 mL D_5W/NS	0.01 - 5 mg/min	5 mg/mL
Lidocaine	200 mg	50 mL D_5W/NS	1 - 4 mg/min	4 mg/mL
Magnesium	5 g	250 mL D_5W/NS	1000 - 2000 mg/hr	20 mg/mL
Midazolam	50 mg	50 mL D_5W/NS	0.01 - 0.25 mg/kg/hr	1 mg/mL
Milrinone	20 mg	100 mL D_5W/NS	0.01 - 0.75 mcg/kg/min	200 mcg/mL
Morphine	50 mg	50 mL D_5W/NS	0.01 - 25 mg/hr	1 mg/mL
Naloxone	10 mg	100 mL D_5W/NS	0.4 - 6 mg/hr	0.1 mg/mL
Nitroglycerin	50 mg	250 mL D_5W/NS	5 - 200 mcg/min	200 mcg/mL
NitroPRUSSide	50 mg	250 mL D5W/NS	0.01 - 10 mcg/kg/min	200 mcg/mL
Norepinephrine (PVL)	4 mg	250 mL D_5W/NS	0.01 - 1 mcg/kg/min	16 mcg/mL
Norepinephrine (CVL)	8 mg	250 mL D_5W/NS	0.01 - 1 mcg/kg/min	32 mcg/mL
Norepinephrine (CVL)	16 mg	250 mL D_5W/NS	0.01 - 1 mcg/kg/min	64 mcg/mL
Octreotide	500mcg	100 mL D_5W/NS	0.01 - 50 mcg/hr	5 mcg/ml
Oxytocin	40 units	1000 mL D_5W/NS	2.5 - 10 units/hr	0.04 units/mL
Pantoprazole	80 mg	100 mL D_5W/NS	1 - 8 mg/hr	0.8 mg/mL
Phenylephrine	10 mg	250 mL D_5W/NS	5 - 200 mcg/min	40 mcg/mL
Potassium	10 mEq	100 mL D_5W/NS	0 - 10 mEq/hr	0.1 mEq/mL
Procainamide	1 g	250 mL D_5W/NS	1 - 6 mg/min	4 mg/mL
Propofol	N/A (premixed)	500 mg/50 mL premixed	0.01 - 8 mg/kg/hr	10 mg/mL
Rocuronium	100 mg	50 mL D_5W/NS	0.01 - 15 mcg/kg/min	2 mg/mL
Salbutamol	50 mg	500 mL D_5W/NS	0.01 - 5 mcg/kg/min	100 mcg/mL
Vasopressin	40 units	100 mL D_5W/NS	0.02 - 0.1 units/min	0.4 units/mL
Vecuronium	10 mg	100 mL D_5W/NS	0.6 - 1.8 mcg/kg/min	100 mcg/mL
Remove drug volume from diluent to ensure accurate dosing.				

Nov-19