



**MICHIGAN
State Protocols**

Protocol Number

**Protocol Name
Adult Cardiac
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Cardiac Arrest – General

This protocol should be followed for adult cardiac arrests. Medical cardiac arrest patients undergoing attempted resuscitation should not be transported unless return of spontaneous circulation (ROSC) is achieved, transport is ordered by medical control or otherwise specified in protocol.

- If an arrest is of a known traumatic origin, refer to the **Traumatic Arrest Protocol**.
 - If it is unknown whether the arrest is traumatic or medical, continue with this protocol.
 - Patients displaying a Do Not Resuscitate order or bracelet – follow **DNR Procedure**.
 - Initiate ALS response if available.
 - CPR should be consistent with current guidelines established by the American Heart Association.
 - Focus should be on prompt defibrillation and effective chest compressions.
1. Confirm Arrest
 - A. Assess breathing (Cardiac arrest patients may have gasping or agonal breathing).
 - B. Check a carotid/femoral pulse for not more than 10 seconds.
 2. Initiate CPR or continue CPR; apply and use AED/defibrillator (per **Electrical Therapy Procedure**) as soon as available.
 3. Ensure high quality CPR
 - A. Chest compression rate is 100 to 120/min.
 - B. Chest compression depth for adults is 2 inches (5 cm) but not greater than 2.4 inches (6 cm).
 - C. Allow complete chest recoil after each compression,
 - D. Minimize interruptions in compressions.
 - E. Avoid excessive ventilation.
 - F. Restart CPR immediately after any defibrillation attempts.
 - G. Keep pauses in CPR to a minimum. Immediately after AED recommends shock resume compressions until AED is fully charged, then immediately after shock, resume compressions without checking pulse or rhythm. Avoid pauses in CPR during airway management.
 - H. CPR sequence is CAB (Compressions, Airway, Ventilation) for all ages, except the ABC sequence should be used in drowning.
 - I. For pregnant patients, a rescuer should manually displace the uterus to the patient's left during CPR.
 - J. Change rescuer doing compressions every 1-2 minutes (100-200 compressions) to avoid fatigue.
 4. Establish a patent airway, maintaining C-Spine precaution if indicated, using appropriate airway adjuncts and high flow oxygen. See **Emergency Airway Procedure**.
 5. Reassess ABC's as indicated by rhythm or patient condition change. Pulse checks should take no more than 10 seconds. If no pulse after 10 seconds, assume pulselessness, continue CPR.



6. If Return of Spontaneous Circulation (ROSC) has not been achieved after three, two minute cycles of CPR and ALS is not available or delayed, contact medical control, initiate transport.



7. Start an IV/IO NS KVO. If IV is attempted and is unsuccessful, after 2 attempts start an IO line per **Vascular Access & IV Fluid Therapy Procedure**. IO may be first line choice.

8. If hypovolemia suspected: Give one liter bolus, may repeat as necessary, Normal Saline Solution.



9. If quantitative waveform capnography is available and ETCO₂ is < 10 mm Hg, attempt to improve CPR quality.

10. Administer Epinephrine 1 mg/10 ml 1 mg IV/IO every 3 to 5 minutes

11. Prior to advanced airway placement, utilize ventilation periods to visualize the ECG rhythm without compression artifact, this will allow you to plan ahead for the assessment period at the end of the two minute CPR cycle.

12. Administer antidysrhythmic according to rhythm check

A. For Ventricular Fibrillation (VF) or pulseless Ventricular Tachycardia (VT), per MCA selection, administer Amiodarone 300 mg IV/IO OR Lidocaine 100mg IV/IO

Per MCA Selection

Amiodarone 300mg IV/IO (May repeat once 150 mg IV/IO)

or

Lidocaine 100mg IV/IO (May repeat, every 5-10 minutes, 0.5 mg/kg, up to total dose of 3 mg/kg)

B. For suspected torsades de pointes administer Magnesium Sulfate 2 g IV/IO

13. Consider and treat reversible causes of cardiac arrest.

a. If suspected hyperkalemia or tricyclic antidepressant overdose, administer Sodium Bicarbonate 1mEq/kg IV/IO

b. If hyperkalemia suspected in dialysis patient administer:
Calcium Cl (10%) 1gm/10 mL IV/IO

c. Assess for tension pneumothorax or misplaced ETT:

i. If tension pneumothorax suspected, perform needle decompression per procedure for pleural decompression.

d. Hypothermia, follow **Hypothermia Cardiac Arrest Protocol**.

14. After insertion of advanced airway, monitor capnography to confirm appropriate tube placement and deliver continuous CPR, without pauses for ventilation. Ventilations delivered at 8-10 breaths per minute or 1 breath every 6 - 8 seconds.



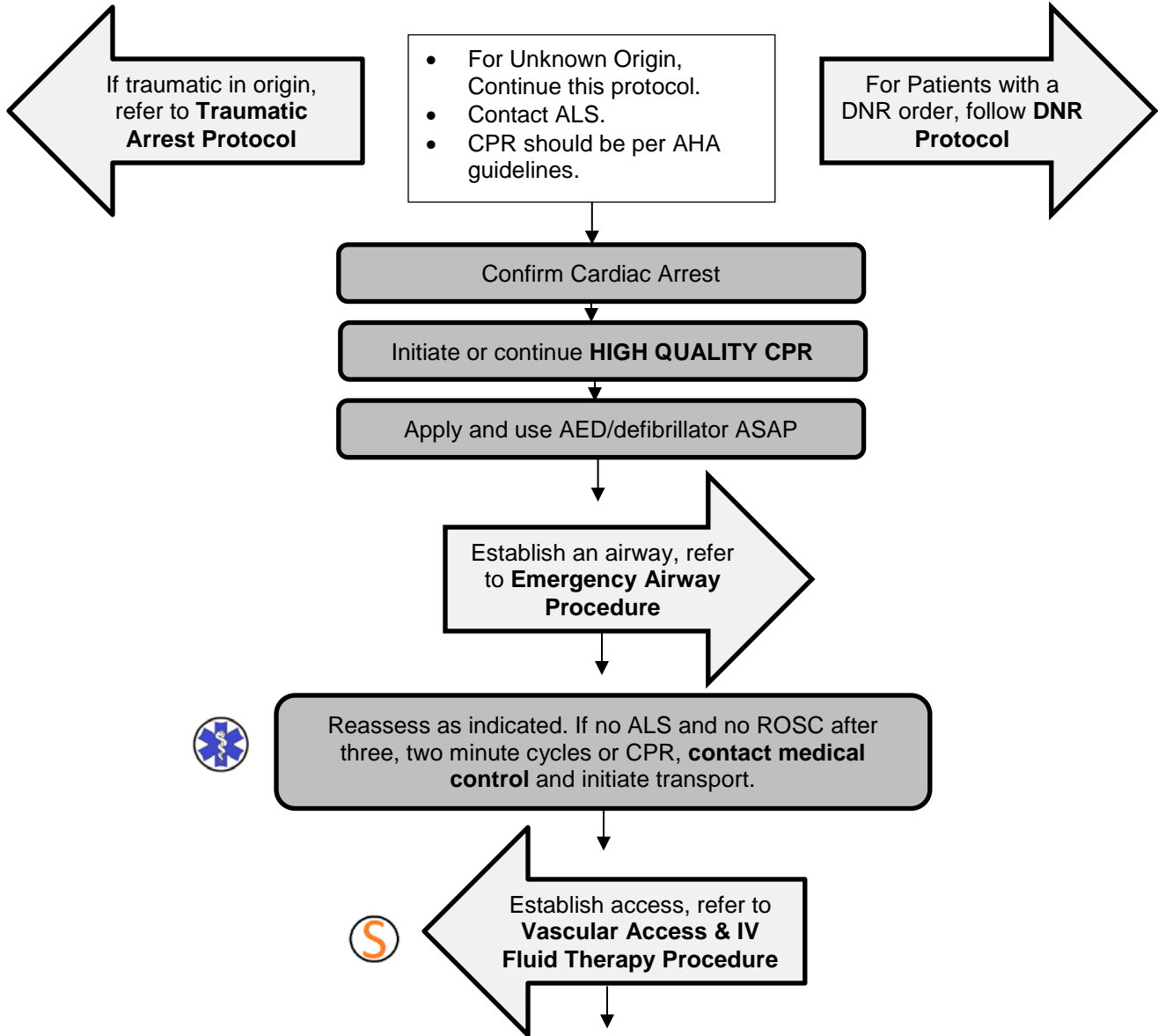
15. Additional basic and/or advanced life support care as appropriate.

16. Consider termination of resuscitation per **Termination of Resuscitation Protocol**.

Notes:

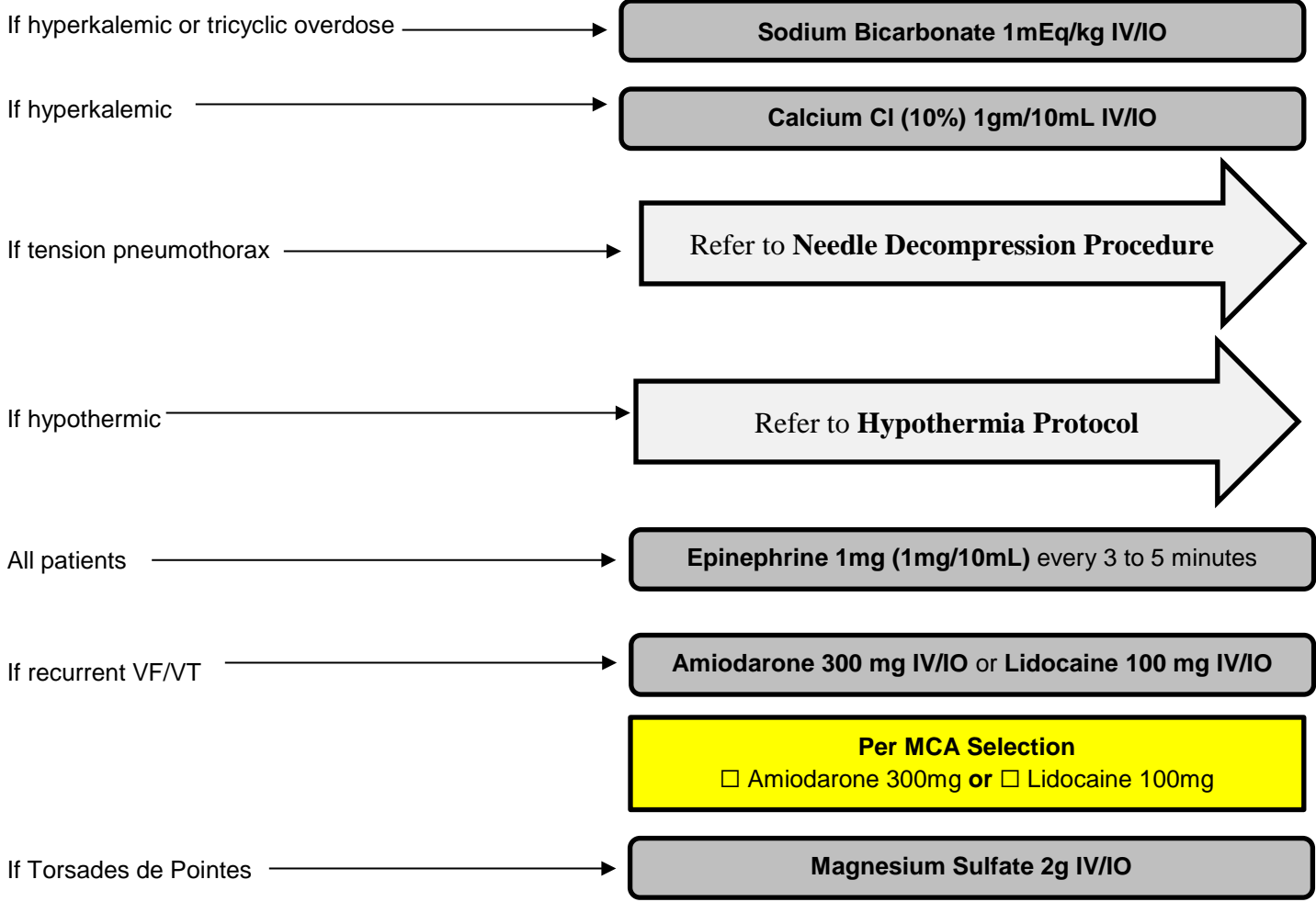
1. Excellent CPR is a priority:
 - A. 30 compressions: 2 ventilations in groups of 5 cycles, over 2 minutes.
 - B. Push hard ≥ 2 inches and fast (≥ 100 /min) and allow full recoil of chest during compressions.
 - C. Change rescuer doing compressions every 2 minutes to avoid fatigue or utilize automated mechanical CPR devices, if available.
 - D. Restart CPR immediately after any defibrillation attempts.
 - E. Keep pauses in CPR to a minimum by checking rhythm when rotating rescuer doing compressions and by avoiding pauses in CPR during airway management and other interventions.
 - F. If AED has been applied by BLS personnel, skip to appropriate place in protocol that incorporates previous care. ALS personnel should switch to manual defibrillator after initial AED shock or place AED in manual mode.
 - G. For biphasic devices shock with energy levels following manufacturers' recommendations (120 – 200 J). If unknown use the maximum available. For monophasic devices use 360 J.
 - H. Confirm and document tube placement by physical exam, measurement of exhaled CO₂ and/or use of other MCA approved secondary confirmation device.
 - I. If possible, contact medical control prior to moving or transporting patient.
 - J. Continue resuscitation attempts and initiate transport, unless field termination is ordered by Medical Control.
 - K. Treat reversible causes.
 - L. Manual chest compressions remain the standard of care for the treatment of cardiac arrest. Mechanical chest compression devices may be a reasonable alternative to conventional CPR in specific settings where the delivery of high-quality manual compressions may be challenging or dangerous for the provider (eg, limited rescuers available, prolonged CPR, CPR during hypothermic cardiac arrest, CPR in a moving ambulance).
 - M. Supraglottic airways are an acceptable alternative for endotracheal intubation.
 - N. An impedance threshold device may be utilized during CPR, if available. Device should be discontinued immediately upon return of spontaneous circulation.

This protocol should be followed for all adult **Cardiac Arrests**. Medical cardiac arrest patients undergoing attempted resuscitation **should not be transported** unless return of spontaneous circulation (ROSC) is achieved or transport is ordered by medical control or otherwise specified in protocol.

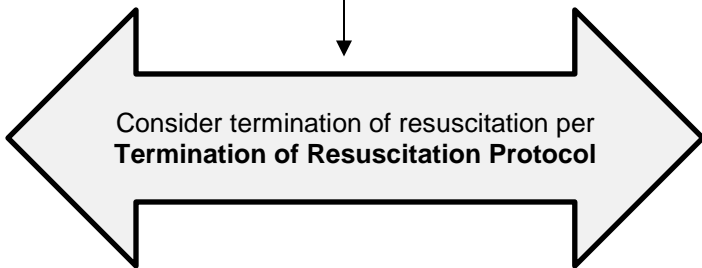




Consider and treat reversible causes of cardiac arrest



Contact Medical Control



Bradycardia

This is a protocol for patients with serious symptomatic bradycardia, defined as patients with heart rate less than 60 bpm and hypotension, or shock. Titrate treatments to a heart rate above 60 bpm. If the patient remains hypotensive, refer to the **Shock Protocol**.

1. Follow the **General Pre-Hospital Care Protocol**.



2. Administer Atropine 0.5 mg IV/IO repeating every 3-5 minutes to a total dose of 3 mg IV/IO, until a heart rate of greater than 60 /minute is reached.
3. Transcutaneous pacing (TCP) when available may be initiated prior to establishment of IV access and/or before Atropine begins to take effect. Pacing is the treatment of choice for high degree A-V block. Follow the **Electrical Therapy Procedure**.
4. Per MCA selection, provide sedation per **Patient Sedation Procedure**.
5. For patients with persistent symptomatic bradycardia, administer Epinephrine by push dose (dilute boluses)
 - a. Prepare (10 mcg/mL) by adding 1mL of 1mg/10mL Epinephrine in 9mL NS, then
 - b. Administer 1-2 mL
 - c. Repeat every 3 to 5 minutes
 - d. Titrate SBP greater than 90 mm/Hg

Notes:

1. Some patients may not tolerate the pacing stimulus to the skin and chest wall that occurs with transcutaneous pacing. In these cases, consider sedation if SBP > 90. (See **Patient Sedation Procedure**)
2. Consider possible etiologies:
 - A. Hyper/hypokalemia, other metabolic disorders
 - B. Hypothermia
 - C. Hypovolemia (including vomiting/diarrhea)
 - D. Hypoxia
 - E. Toxins/ overdose (e.g. beta-blocker or calcium channel-blocker)
 - F. Tamponade
 - G. Tension pneumothorax
3. Transcutaneous pacemaker electrode pads may be applied to these patients without initiating pacing so that the pacemaker is ready if patient condition deteriorates.
4. For symptomatic high-degree (second-degree or third-degree) AV block, begin pacing without delay.
5. Atropine 0.5 mg should be administered by rapid IV/IO push and may be repeated every 3-5 minutes, to a maximum dose of 3 mg. Atropine is ineffective and should be avoided in heart transplant patients.



Tachycardia

This protocol is for paramedic use only

Aliases: SVT, V-tach, Supraventricular tachycardia, Ventricular Tachycardia, Uncontrolled Atrial Fibrillation, A-fib

This protocol is used for the care of patients with persistent tachycardia (ventricular rate greater than or equal to 150/minute) where the tachycardia is believed to be the primary cause of the patient's symptoms. It is not intended to treat tachycardia that is secondary to underlying conditions (i.e., dehydration, trauma or toxins). Consultation with online medical control should be considered for complex patients in whom the cause of the arrhythmia is not obvious. **SYNCHRONIZED CARディオVERSION PRECEDES DRUG THERAPY FOR UNSTABLE PATIENTS.** Unstable patients may be defined as those suffering a tachycardia with: hypotension, acutely altered mental status, signs of shock, significant ischemic chest discomfort, shortness of breath, or pulmonary edema that is likely due to the arrhythmia. Adenosine is only used for regular monomorphic rhythm tachycardia.

1. Follow the **General Pre-Hospital Care Protocol**.
2. Identify and treat reversible causes.
3. Determine if patient is stable or unstable.

UNSTABLE

4. If time and condition allow prior to cardioversion, sedate per MCA selection. Refer to **Patient Sedation Procedure**.
5. For unstable patients with a **REGULAR NARROW OR WIDE** rhythm, perform synchronized cardioversion beginning at 100 J, increasing to 200 J, 300 J, 360 J. (Use manufacturers suggested biphasic energy dose, 100 J).
6. For unstable patients with an **IRREGULAR NARROW** rhythm, perform synchronized cardioversion beginning at 200 J, increasing to 300 J, 360 J. (Use manufacturers suggested biphasic energy dose, 120 – 200 J).
7. For patients that are unstable with an **IRREGULAR WIDE** rhythm, perform defibrillation beginning at 200 J, increasing to 300 J, 360 J. (Use manufacturers suggested biphasic energy dose 150 – 200 J).

STABLE

8. Attempt Vagal Maneuvers
 - a. Ensure the patient is on oxygen and on a cardiac monitor.
 - b. Run ECG strip during the procedure.
 - c. Instruct the patient to cough forcefully several times or
 - d. Have the patient take a deep breath and bear down.
 - e. **DO NOT USE CAROTID MASSAGE.**
9. Start an IV NS KVO. A large bore antecubital IV should be secured whenever possible.
10. Obtain 12 lead ECG, if immediately available.
11. If the rhythm is regular, consider Adenosine 6 mg rapid IV push through the most proximal injection site. This should be followed immediately with 20 ml NS flush.

12. If conversion does not occur, administer Adenosine 12 mg IV using the same technique as stated above.



13. If rhythm is stable with narrow QRS contact medical control for possible orders.

14. If rhythm is stable with wide QRS administer Amiodarone **OR** Lidocaine per MCA Selection.

Medication Options
(Choose One)

Amiodarone - 150 mg IV over 10 minutes

OR

Lidocaine - 1 mg/kg IV

15. If at any point a patient becomes unstable, perform synchronized cardioversion.

16. Administer Magnesium Sulfate 2 gm IV/IO for suspected torsades de pointes.








17. Per MCA selection, administer additional Amiodarone 150 mg IV over 10 minutes as needed to a maximum of 450 mg OR Lidocaine 0.5 -1.0 mg/kg IV push every 5 - 10 minutes to a maximum of 3 mg/kg.

NOTES:

1. Administration of Amiodarone is best accomplished by adding Amiodarone 150 mg to 100 or 250 ml of NS and infusing over approximately 10 minutes.
2. Administration of Magnesium Sulfate is best accomplished by adding Magnesium Sulfate 2gm to 100 or 250 ml of NS and infusing over approximately 10 minutes.

Pulmonary Edema / CHF

This protocol is to be followed for patients in acute respiratory distress situations, not chronic.

1. Follow **General Pre-Hospital Care Protocol**.
2. Initiate supplemental oxygen by non-rebreather mask.
3. Position patient upright with legs dependent, if possible.
-  4. Consider CPAP (if available) per **CPAP/BiPAP Procedure**.
-  5. Inquire of all patients (male and female) if they have taken Viagra (sildenafil citrate) or similar erectile dysfunction medications or medications used to treat pulmonary hypertension in the last 48 hours. If yes, **DO NOT ADMINISTER NITROGLYCERIN AND CONTACT MEDICAL CONTROL.** 
6. If BP above 100 mmHg, administer Nitroglycerin 0.4 mg SL. Repeat every 3-5 minutes if BP above 100 mmHg. Nitroglycerin may be administered prior to IV placement if the BP is above 120 mmHg. Continue administration in the presence of CPAP.
7. If wheezing, administer nebulized Albuterol 2.5 mg/3ml.
-  8. If indicated, consider an advanced airway.
9. Obtain 12-lead ECG if available. Follow local MCA transport protocol if ECG is positive for ST segment elevation myocardial infarction (STEMI) and alert hospital as soon as possible. (May be a BLS skill, per MCA selection, see **12 Lead ECG Procedure**)
-  10. If BP is less than 100 mmHg and signs/symptoms of shock, administer Epinephrine by push dose (dilute boluses) per **Epinephrine Protocol**.
 - a. Prepare (10 mcg/mL) by adding 1mL of 1mg/10mL Epinephrine in 9mL NS, then
 - b. Administer 1-2 mL every 2 to 5 minutes and titrate SBP greater than 90 mm/Hg.

This protocol is to be followed for patients in acute respiratory distress situations, not chronic.

Follow **General Pre-Hospital Care Protocol**.

- Initiate supplemental oxygen by non-rebreather mask.
- Position patient upright with legs dependent, if possible.



Consider CPAP per
**CPAP/BiPAP
Procedure**



- Inquire of all patients (male and female) if they have taken Viagra (sildenafil citrate) or similar erectile dysfunction medications or medications used to treat pulmonary hypertension in the last 48 hours. If yes, **DO NOT ADMINISTER NITROGLYCERIN AND CONTACT MEDICAL CONTROL**.
- If BP above 100 mmHg, administer Nitroglycerin 0.4 mg SL. Repeat every 3-5 minutes if BP above 100 mmHg. Nitroglycerin may be administered prior to IV placement if the BP is above 120 mmHg. Continue administration in the presence of CPAP.

If wheezing, administer nebulized Albuterol 2.5 mg/3ml.



Obtain 12 Lead ECG



Contact Medical Control

Administer push dose
Epinephrine per
Epinephrine Protocol

Chest Pain/Acute Coronary Syndrome


The goal is to reduce cardiac workload and to maximize myocardial oxygen delivery by reducing anxiety, appropriately oxygenating and relieving pain. For non-cardiac causes of chest pain, refer to appropriate protocol which may include **Pain Management Procedure**.

1. Follow **General Pre-Hospital Care Protocol**.
2. Administer oxygen 4 L/min per nasal cannula if pulse oximetry is not available. Oxygen is only required if pulse oximetry SaO₂ < 94%.




3. Assist patient in the use of their own aspirin (if MCA approved, and patient not allergic to aspirin, administer aspirin up to 325 mg). Aspirin should be chewed and swallowed.

MCA selection for MFR MCA selection for EMT

4. Inquire of all patients (male and female) if they have taken Viagra (sildenafil citrate) or similar erectile dysfunction medications or medications used to treat pulmonary hypertension in the last 48 hours. If yes, **DO NOT ADMINISTER NITROGLYCERIN AND CONTACT MEDICAL CONTROL.** 
5. Assist patient in the use of their own Nitroglycerin sublingual tabs (check expiration date), if available, and if the patient's systolic BP is above 120 mmHg, for a maximum of 3 doses.



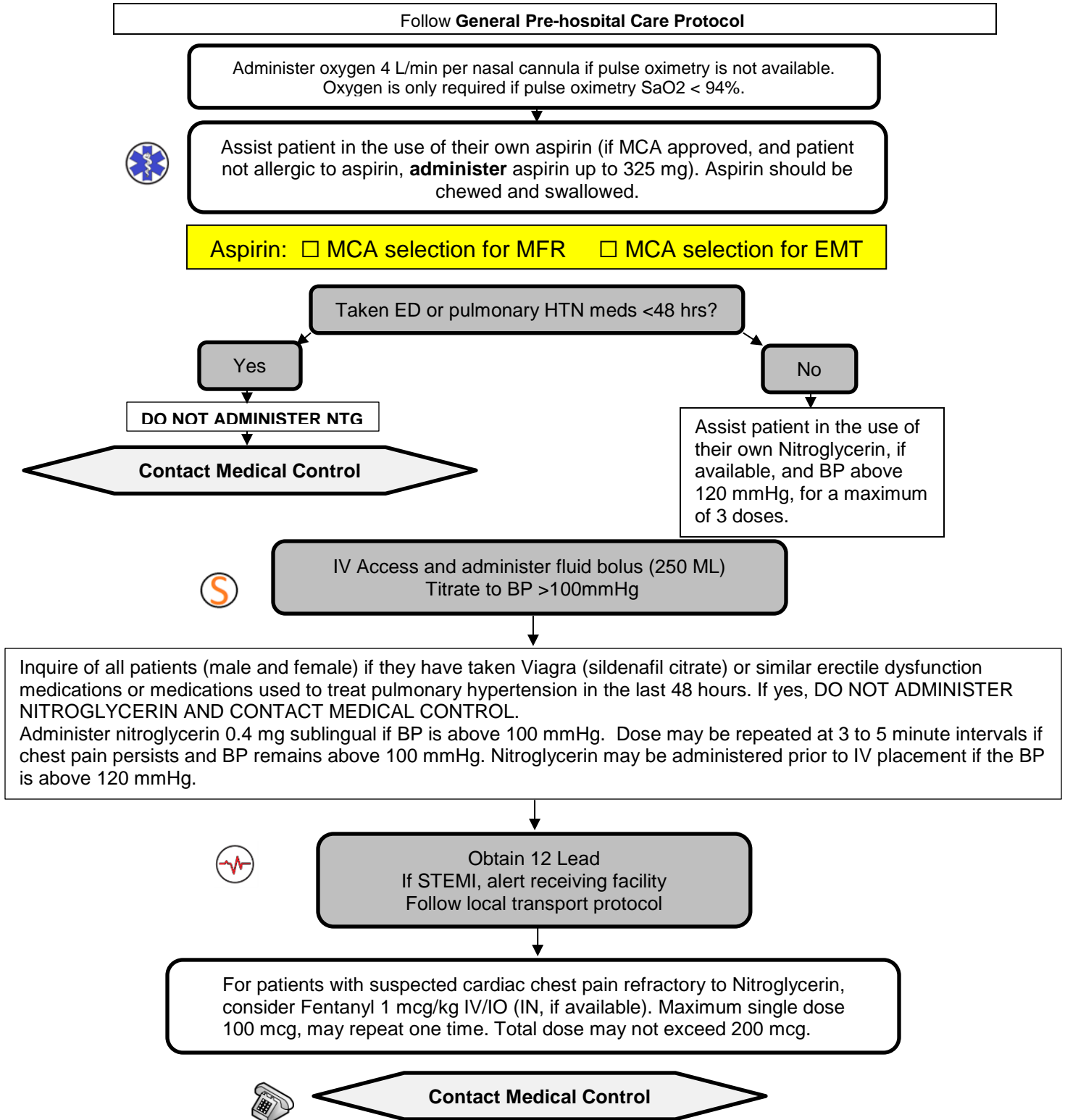
6. Administer aspirin up to 325 mg PO, chew and swallow if no aspirin or suspected insufficient dose since the onset of chest pain.
7. Start an IV NS KVO. If the patient has a BP of less than 100 mmHg, administer an IV/IO NS fluid bolus up to 1 liter wide open, in 250 ml increments and reassess.
8. Inquire of all patients (male and female) if they have taken Viagra (sildenafil citrate) or similar erectile dysfunction medications or medications used to treat pulmonary hypertension in the last 48 hours. If yes, **DO NOT ADMINISTER NITROGLYCERIN AND CONTACT MEDICAL CONTROL.** 
9. Administer nitroglycerin 0.4 mg sublingual if BP is above 100 mmHg. Dose may be repeated at 3 to 5 minute intervals if chest pain persists and BP remains above 100 mmHg. Nitroglycerin may be administered prior to IV placement if the BP is above 120 mmHg.



10. Obtain 12-lead ECG if available. Follow local MCA transport protocol if ECG is positive for acute ST Elevation Myocardial Infarction (STEMI) and alert the hospital as soon as possible. (Per MCA selection, may be a BLS procedure, follow **12 Lead ECG Procedure**)

11. For patients with suspected cardiac chest pain refractory to Nitroglycerin, consider Fentanyl 1 mcg/kg IV/IO (IN, if available). Maximum single dose 100 mcg, may repeat one time. Total dose may not exceed 200 mcg.

The goal is to reduce cardiac workload and to maximize myocardial oxygen delivery by reducing anxiety, appropriately oxygenating and relieving pain. For non-cardiac causes of chest pain, refer to appropriate protocol which may include **Pain Management Procedure**.



MCA Name: [Click here to enter text.](#)

MCA Board Approval Date: [Click here to enter text.](#)

MCA Implementation Date: [Click here to enter text.](#)

Protocol Source/References:



Nitroglycerin Drip Supplement (OPTIONAL)

This protocol is for paramedic use only

Medical Control Authorities choosing to adopt this supplement may do so by selecting this check box. Adopting this supplement changes or clarifies the referenced protocol or procedure in some way. This supplement supersedes, clarifies, or has authority over the referenced protocol.



This protocol provides for the use of a Nitroglycerin Drip in the pre-hospital setting for systems that can justify the use based on long transport times. Implementation of the protocol requires additional paramedic training approved by the Medical Control Authority and Department. A suggested training outline is included in this protocol.

Indications for Nitroglycerin Drip

1. Chest pain secondary to presumed cardiac ischemia, acute coronary syndrome or acute myocardial infarction. The nitroglycerin drip may be used after failure of SL nitroglycerin and narcotic administration to relieve cardiac chest pain treated using the **Chest Pain / Acute Coronary Syndrome** protocol.
2. Acute pulmonary edema / CHF. The nitroglycerin drip may be used as a supplement to SL nitroglycerin treatment using the **Acute Pulmonary Edema / CHF** protocol.

Equipment

1. At least one functioning IV. A second IV preferable to allow additional IV fluid or medication administration.
2. Infusion pump and proper vented tubing are required.

Administrations Guidelines

1. Dosing
 - A. Nitroglycerin is mixed in NS. Dosing chart: see Table I
 - B. For pre-hospital use, begin the nitroglycerin drip at 10 mcg/min and increase by 10 mcg/min at 5 minute intervals if chest pain persists and systolic blood pressure remains above 100 mmHg. Maximum dose is 200 mcg/min.
 - C. If titrating nitroglycerin for Pulmonary Edema/CHF, titrate until systolic BP is 120 or below.
2. Patient monitoring
 - A. If pain resolves completely, maintain drip at current rate of administration.
 - B. If pain continues, increase the drip rate by 10 mcg/min every 5 minutes until pain resolves or systolic BP falls below 100 mmHg.
 - C. If systolic BP falls below 90 mmHg during titration, decrease the drip rate by 10 mcg/min and give a NS IV/IO fluid bolus up to 1 liter, wide open. If BP remains below 90 mmHg, discontinue drip.

Table I. Dosing Chart for Nitroglycerin

Dose (mcg/min)	Amount to infuse in ml/hr	
	50 mg/250 ml 100 mg/500 ml (200 mcg/ml)	100 mg/250 ml 200 mg/500 ml (400 mcg/ml)
10	3	1.5
20	6	3
30	9	5
40	12	6
50	15	8
60	18	9
70	21	10
80	24	12
90	27	14
100	30	15
110	33	17
120	36	18
130	39	19
140	42	21
150	45	23
160	48	24
170	51	26
180	54	27
190	57	29
200	60	30

Nitroglycerin Drip Training Guidelines

Suggested Training Requirements for Paramedics

1. Training requirements for paramedics = 2 hours
 - A. Nitroglycerin training = 1 hour
 - B. Infusion pump training = 1 hour

2. Pharmacology and actions of nitroglycerin
 - A. Cardiovascular effects
 - a. Decreases preload: reduces venous tone, decreasing venous load on the heart.
 - b. Decreases afterload: reduces peripheral vascular resistance.
 - c. Increases myocardial oxygen supply: causes dilatation of coronary arteries and relief of coronary artery spasm.
 - B. Generalized effect: causes generalized smooth muscle relaxation

3. Administrations Guidelines
 - A. Dosing
 - a. Nitroglycerin is mixed in NS. Dosing chart: see Table I.
 - b. For pre-hospital use begin the nitroglycerin drip at 10 mcg/min and increase by 10 mcg/min at 5 minute intervals if chest pain persists and systolic blood pressure remains above 100 mmHg.
 - c. If titrating nitroglycerin for Pulmonary Edema / CHF, titrate until systolic BP is 120 mmHg or below.
 - d. For inter-hospital patient transfers a nitroglycerin drip may be continued at the rate begun at the transferring hospital. Titrate the drip as above to relieve chest pain or per sending facility orders.

4. Patient monitoring and titration of nitroglycerin drip
 - A. Patient should have continuous cardiac rhythm monitoring and frequent blood pressure monitoring. Blood pressure should be rechecked after each dosing change.
 - B. If pain resolves completely, maintain drip at current rate of administration.
 - C. If pain continues, increase the drip rate by 10 mcg/min every 5 minutes until pain resolves or systolic BP falls below 100 mmHg.
 - D. Maximum dose is 200 mcg/min.
 - E. If systolic BP falls below 90 mmHg during titration, decrease the drip rate by 10 mcg/min and give a NS IV/IO fluid bolus up to 1 liter, wide open. If BP remains below 90 mmHg, discontinue drip.

5. Side effects and special notes
 - A. Peripheral vasodilatation can cause profound hypotension and reflex tachycardia.
 - B. Common side effects: throbbing headaches, flushing, dizziness
 - C. Less common: orthostatic hypotension, sometimes marked. Nitroglycerin does not provide controlled hypotension.
 - D. Because nitroglycerin causes generalized smooth muscle relaxation, it may be effective in relieving chest pain caused by esophageal spasm.