

ACLS scenarios for simulation sessions

SCENARIO 1: Radio call; 78-year-old male with a history of CAD, CHF, COPD and CKD who is in cardiac arrest. Arrest was witnessed by family and CPR was started by wife via 911-instruction. At this time, EMS report that they have been on scene for 20 minutes and have given 3 rounds of Epi. Initial rhythm was PEA, he went into ventricular fibrillation (VF) and was defibrillated once. Patient is being bagged via BVM with an end tidal CO₂ (EtCO₂) of 18. No ROSC has been obtained; he is currently in PEA.

Recommendations:

- Per L.A. County Treatment Protocol 1210, and Reference 814, the transport of cardiac arrest patients should be avoided if no return of spontaneous circulation (ROSC) is attained. After ROSC, EMS should stay on scene for 5 minutes to initiate stabilization. If the patient rearrests during this period, they should continue ACLS on scene.
- All patients with cardiac arrest who do not have ROSC prior to base contact and do not meet criteria for termination by 814 (adult patients in asystole at 20 minutes with no ROSC and no shockable rhythm at any time and not witnessed by EMS) require Base Hospital Physician (BHP) involvement. **There is no clear time frame for when a BHP should pronounce death in this situation. The base Physician should get on the radio and get involved with medical treatment to decide if/when futility is achieved.**
- Some considerations the BHP may have include:
 - Given the history of CKD, if concerned about hyperkalemia, consider calcium chloride or bicarbonate if not already given
 - What does the waveform look like to the medics? Sharkfin shape is concerning for an obstructive respiratory pattern and may warrant additional epinephrine beyond the 3-dose maximum
 - The trend in EtCO₂ (i.e. gradually decreasing EtCO₂) may indicate worsening of the patient's clinical status
 - Bicarb administration regularly causes a brief but significant increase in EtCO₂, which should not be confused with ROSC
 - It is often useful to confirm the current BVM rate, as hyperventilation is common, difficult to avoid (per studies in the in-hospital setting) and is associated with decreased likelihood of ROSC and worse neuro outcomes in survivors.
- There are no factors that “mandate” transport or termination in cardiac arrest – a single or multiple episodes of ROSC or defibrillation do not mean the patient must be transported. This is really for the BHP to decide, based on what you think the hospital could offer that might improve patient's outcome.
- Please be aware that a supraglottic airway (SGA) is considered non-inferior (and per several studies preferable) to endotracheal intubation as the initial airway in cardiac arrest. If SGA (King-LT in LA County) is in use with good EtCO₂ waveform (square) and number >10 in cardiac arrest (consistent with high quality CPR), there is no indication to transport “for definitive airway”.

SCENARIO 2: Radio call; 56-year-old male with a history of asthma/COPD, CAD who had an EMS witnessed cardiac arrest while being evaluated for a chief complaint of chest pain. VF was the initial rhythm so the patient was defibrillated twice, and Epi x1 one was administered. ROSC was attained after 6 minutes of

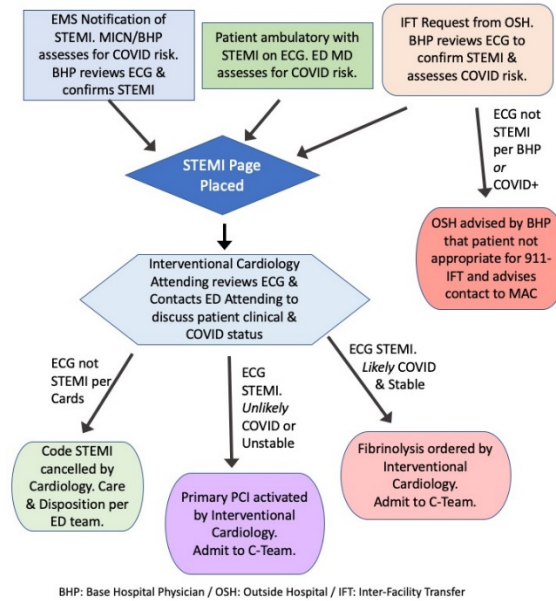
ACLS and EMS is now making base contact reporting a post-ROSC EKG showing possible STEMI. They are about to initiate transport.

Recommendations:

- Per L.A. County Treatment Protocol 1210, and Reference 814, EMS should stay on scene after ROSC for 5 minutes to initiate stabilization. If the patient rearrests during this period, they should continue ACLS on scene.
- You, the BHP, should confirm the patient's post-ROSC GCS and vital signs and recommend that EMS initiate post-ROSC care in the field prior to transport. Post-ROSC care includes those treatments that help decrease the chances of re-arrest and may improve neurologic outcomes. These include:
 - IVF bolus 1 L "squeezed in" if post-ROSC SBP is low
 - Early use of push-dose epinephrine if SBP continues low after 1st 250mL of NS infused
 - Push-dose epinephrine is prepared by mixing 9mL of normal saline with 1mL of the 1:10,000 epinephrine (0.1mg/mL) IV formulation in a 10mL syringe
 - 1mL of this 0.01mg/mL epinephrine formulation is then administered IV/IO (which is 0.01 mg or 10 mcg pushes) every 1-5 minutes as needed to maintain SBP > 90mmHg until hospital arrival
 - SGA/ETT placement if patient is unconscious and not breathing normally post-ROSC
 - Maintaining EtCO₂ between 35-45 and avoiding hyperventilation.
- VF arrest with ROSC in a patient with STEMI on ECG is criteria for STEMI pre-activation, as this patient is likely to benefit from primary PCI. BHP should review the prehospital ECG and **should pre-activate for STEMI**. There is no change in this protocol during the COVID-pandemic.
 - The BHP should ask the EMS crew on the radio about any COVID-related indicators/exposures/history in this patient. If there is suspicion of COVID per EMS, this information should be included in the Code STEMI pre-activation page.
 - On arrival, ED staff should be in "Special Precautions" PPE and should again assess for COVID risk (including rectal temperature). The ED attending is responsible for discussing COVID risk factors (or lack thereof) to Cardiology attending. In some limited cases (for stable STEMI patients with high suspicion for COVID) the Interventional Cardiologist may decide to use thrombolytics as the initial treatment, rather than PCI. If this decision is made, the Cardiology team is responsible for assessing contraindications and placing the orders for thrombolytics.
 - **Tenecteplase (TNK)** is the thrombolytic drug of choice and should be given within 30 minutes of hospital arrival (Door-To-Needle Time ≤ 30 minutes).
 - The recommended total TNK dose is weight-based and should not exceed 50 mg. Administer as a single bolus dose over 5 seconds:
 - <60 kg: 30 mg
 - ≥60 to <70 kg: 35 mg
 - ≥70 to <80 kg: 40 mg
 - ≥80 to <90 kg: 45 mg
 - ≥90 kg: 50 mg

Revised Code STEMI Algorithm

Effective 4/16/2020



SCENARIO 3: Patient above; loses pulses during transport; EMS arrives bagging the patient via BVM and with compressions in progress

Recommendations:

- Receiving providers should don the appropriate PPE (N95 mask, face shield, gown, gloves or CAPR/PAPR, gown and gloves) prior to the patient's arrival for ALL patients for whom aerosol generating procedures (AGPs) are anticipated.
- Prepare all necessary equipment (code medications, LUCAS, trauma shears, etc.) prior to arrival. Place LUCAS back-plate on ED gurney
- Attending should meet EMS on the ambulance ramp; EMS should pull all the way into trauma bay
- The ED attending, while wearing appropriate PPE, should coordinate with EMS to pause compressions and ventilations before entering the hospital (make sure that EMS is ready to move the patient prior to pausing these treatments to minimize the time off-chest). Advise them (in advance) that you (the ED attending) will walk with them and tell them when to restart compressions in the room.
 - Hold BVM in setting of a viral filter without an advanced airway. Consider covering face with a towel/plastic seat in short transport to trauma bay.
- On arrival to the resuscitation bay, advise EMS to continue compressions and ventilations until the receiving team is prepared for transfer from the EMS stretcher to the ED gurney.
- When the ED team is prepared, instruct EMS to pause compressions, move the patient to the gurney, pull the patient to a seated position, remove clothing and covers, and place defibrillation pads to the back and chest.
- Lay the patient back onto the LUCAS board, place top, and initiate compressions.

- Though this is in divergence from recommended ACLS/AHA, if the patient does not already have an ETT/SGA, place an LMA/King-LT with a viral filter (if available).
- Initiate IVs x2 (if not already present)
- Proceed with ACLS treatment as necessary
- Consider intubation with ETT for a definitive airway if ROSC is sustained
- Pulse checks are not indicated if you have continuous waveform EtCO₂ and see-thru-CPR on the Zoll portable bedside monitor. However, you should do a visual rhythm check and reassessment of EtCO₂ and ventilation/compression adequacy at least every 2 minutes. If you cannot tell what the native rhythm is via the filtered rhythm on the Zoll, but the EtCO₂ is < 20 (i.e. unlikely ROSC), consider a very brief hold of CPR (<3 seconds) purely to assess rhythm. Clear communication is crucial to avoid unnecessary/inappropriately long CPR pauses.
- If EtCO₂ suddenly rises in the absence of bicarb administration (especially if it rises to >30) and rhythm is not clearly VF, a pulse and rhythm check with CPR paused is indicated.

SCENARIO 4: Patient above; EMS arrives with an endotracheal tube (ETT) or LMA in situ, compressions ongoing.

Recommendations:

- Receiving providers should don the appropriate PPE (N95 mask, face shield, gown, gloves or CAPR/PAPR, gown and gloves) prior to the patient's arrival for ALL patients for whom AGPs are anticipated.
- Prepare all necessary equipment (code medications, LUCAS, trauma shears, etc.) prior to arrival. Place LUCAS back-plate on ED gurney
- Attending should meet EMS on the ambulance ramp; EMS should pull all the way into trauma bay
- The ED attending, while wearing appropriate PPE, should confirm with EMS what kind of airway they are using and whether they are using a viral filter. **If the patient has an ETT/SGA and Viral Filter in use, ED attending may instruct EMS to continue compressions and ventilations *en route* to the trauma bay.** If no viral filter, or no advanced airway, coordinate with EMS to pause compressions and ventilations before entering the hospital (make sure that EMS is ready to move the patient prior to pausing these treatments to minimize the time off-chest). Advise them (in advance) that you (the ED attending) will walk with them and tell them when to restart compressions in the room.
- On arrival to the resuscitation bay, advise EMS to continue compressions and ventilations until the receiving team is prepared for transfer from the EMS stretcher to the ED gurney.
- When the ED team is prepared, instruct EMS to pause compressions, move the patient to the gurney, pull the patient to a seated position, remove clothing and covers, and place defibrillation pads to the back and chest.
- Lay the patient back onto the LUCAS board, place top, and initiate compressions.
- Place a viral filter in between ETT/SGA and resuscitation bag (if available) or attach directly to ventilator.
- If EMS arrived with a viral filter, **ask to keep their viral filter for continued use with the patient.**
- Continue resuscitation as above

SCENARIO 5: 69-year-old male with a history of CHF and COPD who presented to the ED a few hours ago for shortness of breath. Patient is currently being treated for a mild CHF exacerbation and a moderately severe

COPD exacerbation. COVID test returns as negative and he is currently on BiPAP but has worsening hypercarbia with progressive altered mental status. He subsequently loses pulses with VF on the monitor. Patient is full code.

Recommendations:

- In patients with severe exacerbations of their underlying obstructive lung disease (COPD/asthma), continue with usual care including non-invasive positive pressure ventilation in a negative isolation room with proper PPE, as well as give aggressive therapy upfront (i.e. epinephrine, terbutaline, ketamine and magnesium) in attempt to prevent intubation.
- Providers should don appropriate PPE (N95 mask, face shield, gown, gloves) for cardiac arrest management, **even in the setting of a negative COVID test results**, per DHS Expected Practices
- Proceed with ACLS as usual: given that this patient had a witnessed arrest with a shockable rhythm on the monitor, immediate defibrillation is recommended if possible, followed by CPR
- Early intubation may be beneficial given that this is primarily a respiratory arrest

SCENARIO 6: 74-year-old female with a history of diabetes, hypertension, hyperlipidemia and hyperthyroidism who presented to the ED a few hours ago from her SNF for a fever, cough and shortness of breath. Patient was found to be COVID positive with signs of ARDS on her x-ray. She was intubated on arrival but has had increasing oxygen requirements despite proning and APRV. She subsequently loses pulses with VF on the monitor.

Recommendations:

- ED team should **discuss code status with patient and/or their family/decision maker as soon as possible after their initial ED presentation**. Code status should be well known to providers and verified at the time of emergency.
- Managing providers don the appropriate PPE (N95 mask, face shield, gown, gloves)
- If additional time is required for the team to don PPE, the initial provider (in appropriate PPE) may enter the room to place defibrillation pads (if not already in place), assess for a shockable tachydysrhythmia (VF in this case); and deliver up to 3 shocks.
- CPR and ACLS care may be initiated when the remaining team members are available.
 - LUCAS should be taken into the room as soon as feasible.
 - The number of people present in the room should be limited to five individuals: a respiratory care practitioner (RCP), two nurses, and two physicians (trainee and attending) if the LUCAS is available. If not available, an additional 1-2 persons may be necessary to function as compressors.
 - An additional nurse (as a recorder), the ED pharmacist, and additional compressors should be available outside the room.
 - A baby monitor should be used to facilitate in-room to out-of-room communication
- If not previously discussed, prompt determination of the patient's code status should be performed with the family; if the **patient is found to be DNR** the code can be terminated at this point

SCENARIO 7: A 54-year-old female with a history of diabetes and hypertension presented to the ED a few hours ago for a fever, cough and shortness of breath. The patient was found to be COVID positive and was

initially managed with oxygen by nasal canula. However, she has had increasing oxygen requirements so the decision is made to intubate. Post-intubation, she becomes hypotensive and subsequently loses pulses with VF on the monitor.

Recommendations:

- Treating providers don the appropriate PPE (N95 mask/face shield or CPAR/PAPR, gown, gloves) if prior PPE was already doffed post-intubation
- If additional time is required for the team to don PPE, the initial provider (in appropriate PPE) may enter the room to place defibrillation pads (if not already in place), assess for a shockable tachydysrhythmia; and deliver up to 3 shocks
- CPR and ACLS care may be initiated when the remaining team members are available
 - LUCAS should be taken into the room as soon as feasible.
 - The number of people present in the room should be limited to five individuals: a respiratory care practitioner (RCP), two nurses, and two physicians (trainee and attending) if the LUCAS is available. If not available, an additional 1-2 persons may be necessary to function as compressors.
 - An additional nurse (as a recorder), the ED pharmacist, and additional compressors should be available outside the room.
 - A baby monitor should be used to facilitate in-room to out-of-room communication
- As in any cardiac arrest of an intubated patient, verification of the airway should be considered via the DOPE mnemonic; intubation complications may lead to cardiac arrest.
- As the patient was intubated prior to the code, and if you have ruled out dislodgement, obstruction, tension pneumothorax, and equipment failure, the ventilator can be programmed to deliver breaths in CPR in lieu of reverting to BVM ventilation. Per AHA recommendations, the ventilator settings should be adjusted to allow for asynchronous ventilation (the following steps can be used)
 - Increase the FIO₂ to 1.0
 - Change the ventilator mode to **Pressure Control Ventilation (Assist Control)** and limit pressure as needed to generate adequate chest rise (6 mL/kg ideal body weight is often targeted)
 - Adjust the trigger to “Off” to prevent the ventilator from auto-triggering with chest compressions and possibly prevent hyperventilation and air trapping.
 - ***Other option would be to keep the ventilator on the Volume assist-control setting and remove the “assist” by turning the trigger to “Off”. This helps guarantee that minute ventilation is set independent of patient lung compliance
 - Adjust the respiratory rate to 10/min for adults
 - Assess the need to adjust positive end-expiratory pressure level to balance lung volumes and venous return.
 - Adjust alarms to prevent alarm fatigue.
 - Ensure endotracheal tube/tracheostomy and ventilator circuit are properly secured to prevent unplanned extubation/dislodgement.
- Proceed with ACLS treatment as necessary
- Consider early discussion of code status with next-of-kin/family
- If return of spontaneous circulation is achieved, set ventilator settings as appropriate to patients' clinical condition.

*Adapted from EM Updates (Reuben Strayer). Available at: <https://vimeo.com/402790337>