Supplemental Digital Content 1. Simulation scenarios and critical action checklist for debriefing

Simulation Scenario #1

I. Title

(ACS)-VF-Asystole-ROSC

II. Target learner

6-7 medical students per team

III. Learning objectives

At the end of the SIM session, the student team should be able

1. To recognize cardiac arrest early and perform high-quality CPR
2. To recognize shockable arrest early and perform early defibrillation
3. To recognize non-shockable arrest early and verbalize potential reversible causes of arrest
4. To perform effective team dynamics

IV. Patient case

- M/56, sudden collapse after complaining chest discomfort at the ED triage area
- Past history or social history: unknown

V. Flow of scenario

- Sudden collapse after complaining chest pain at the ED triage area and move to resuscitation bed
- Initial ECG rhythm: coarse VF
- Clinical progress

  VF → 1st shock and CPR → ..(Refractory VF).. → 5th rhythm check: asystole → …. → 8th rhythm check: ROSC

After ROSC (V/S 98/62-134-20-36.5℃, ECG rhythm: sinus tachycardia)

VI. Critical action checklist

Critical action	
1. Recognize cardiac arrest early and perform high-quality CPR	
Recognize cardiac arrest early and call for help (<30sec)	☐
Immediately start chest compressions (<30sec)	☐
Push hard (≥5cm) and fast (≥100/min)	☐
Allow complete chest recoil	☐
Minimize interruption in chest compressions (<10sec)	☐
Avoid excessive ventilation (1 breath/6~8sec)	☐
Rotate compressor every 2 minutes	☐
2. Recognize shockable arrest early and perform early defibrillation	
Recognize ventricular fibrillation (<30sec)	☐
Clear before ANALYZE and SHOCK	☐
Immediately resume compressions after shock (<10sec)	☐
Appropriate cycles Drug-Rhythm check/Shock-CPR	☐
Administer appropriate drugs and doses	☐
3. Recognize non-shockable arrest early and verbalize potential reversible causes of arrest	
Recognize asystole (<30sec)	☐
Verbalizes potential reversible causes of arrest (H's and T's)	☐
Administer appropriate drug(s) and doses	☐
Immediately resumes CPR after rhythm checks (<10sec)	☐

4. Perform effective team dynamics	
Closed-loop communication	☐
Clear messages	☐
Clear roles and responsibilities	☐
Knowing one's limitations	☐
Knowledge sharing	☐
Constructive intervention	☐
Reevaluation and summarizing	☐
Mutual respect	☐

VII. Set-up

- Monitor (ECG, NBP, SpO2)
- Defibrillator, CPR cart with airway devices, oxygen flowmeter, troponin I kit
- Angio needle, IV line set, drugs: NS10, epinephrine, amiodarone, calcium gluconate, sodium bicarbonate, glucose, insulin, aspirin, nitroglycerin, morphine
- ED 12-leads ECG, portable X-ray, ABG data are presented on the LCD monitor
- Pulseless arrest algorithm on the wall
- SimMan with sweat

VIII. Debriefing plan

- use the evaluation results of checklist above

Simulation scenario #2

I. Title

(Hyperkalemia)-PEA-Asystole

II. Target learner

6-7 medical students per team

III. Learning objectives

At the end of the SIM session, the student team should be able

1. To recognize cardiac arrest early and perform high-quality CPR
2. To recognize non-shockable arrest early and verbalize potential reversible causes of arrest
3. To perform effective team dynamics

IV. Patient case

- M/63
- Chief complaints: dyspnea & decreased mentality
- Present illness: He is a known CKD patient and had fever and generalized weakness for 5 days. He couldn't have the dialysis on last Saturday. His dyspnea was aggravated in this morning and called 119. During the EMS transportation, his mental status was decreased and he was just arrived in the ED resuscitation bed.
- Past history: DM, CKD – HD (Tue, Thur, Sat)

V. Flow of scenario

- Decreased mentality during EMS transportation and just arrived in the ED resuscitation bed.
- Initial ECG rhythm: PEA (idioventricular rhythm, rate 20/min)
- Clinical progress

PEA → CPR → …. →6th rhythm check: asystole,

if hyperkalemia is corrected → …. → 8th rhythm check: ROSC

if hyperkalemia is not corrected → …. → 8th rhythm check: asystole and stop scenario

After ROSC (V/S 78/44-58-20-36.5℃, ECG rhythm: sinus bradycardia)

VI. Critical action checklist

Critical action	
1. Recognize cardiac arrest early and perform high-quality CPR	
Recognize cardiac arrest early and call for help (<30sec)	☐
Immediately start chest compressions (<30sec)	☐
Push hard (≥5cm) and fast (≥100/min)	☐
Allow complete chest recoil	☐
Minimize interruption in chest compressions (<10sec)	☐
Avoid excessive ventilation (1 breath/6~8sec)	☐
Rotate compressor every 2 minutes	☐
2. Recognize non-shockable arrest early and verbalize potential reversible causes of arrest	
Recognize asystole (<30sec)	☐
Verbalizes potential reversible causes of arrest (H's and T's)	☐
Administer appropriate drug(s) and doses	☐
Immediately resumes CPR after rhythm checks (<10sec)	☐
3. Perform effective team dynamics	
Closed-loop communication	☐
Clear messages	☐
Clear roles and responsibilities	☐

Knowing one's limitations	☐
Knowledge sharing	☐
Constructive intervention	☐
Reevaluation and summarizing	☐
Mutual respect	☐

VII. Set-up (for operators or coordinators)

- Monitor (ECG, NBP, SpO2)
- Defibrillator, CPR cart with airway devices, oxygen flowmeter, troponin I kit
- Angio needle, IV line set, drugs: NS10, epinephrine, amiodarone, calcium gluconate, sodium bicarbonate, glucose, insulin, aspirin, nitroglycerin, morphine
- ED 12-leads ECG, portable X-ray, ABG data are presented on the LCD monitor
- Pulseless arrest algorithm on the wall
- SimMan with sweat

VIII. Debriefing plan

- use the evaluation results of checklist above

Test simulation scenario

I. Title

(ACS)-(VF)-Asystole-VF-Asystole

II. Target learner

6-7 medical students per team

III. Learning objectives

At the end of the SIM session, the student team should be able

1. To recognize cardiac arrest early and perform high-quality CPR
2. To recognize shockable arrest early and perform early defibrillation
3. To recognize non-shockable arrest early and verbalize potential reversible causes of arrest
4. To perform effective team dynamics

IV. Patient case

- M/47, sudden collapse at a public place, bystander CPR (-), EMS defribrillation (+) - 3 shocks, EMS CPR (+)
- Past history or social history: unknown

V. Flow of scenario (for facilitators and specialists)

- Sudden collapse at a public place and just arrived in ED resuscitation bed
- Initial ECG rhythm: asystole
- Clinical progress

Asystole → CPR → 2nd rhythm check: VF → shock and CPR → ..(Refractory VF).. →5th rhythm check: asystole → 8th rhythm check: ROSC

After ROSC (V/S 85/49-94-20-36.5℃, ECG rhythm: normal sinus rhythm)

VI. Critical action checklist (for facilitators)

Critical action	
1. Recognize cardiac arrest early and perform high-quality CPR	
Recognize cardiac arrest early and call for help (<30sec)	☐
Immediately start chest compressions (<30sec)	☐
Push hard (≥5cm) and fast (≥100/min)	☐
Allow complete chest recoil	☐
Minimize interruption in chest compressions (<10sec)	☐
Avoid excessive ventilation (1 breath/6~8sec)	☐
Rotate compressor every 2 minutes	☐
2. Recognize shockable arrest early and perform early defibrillation	
Recognize ventricular fibrillation (<30sec)	☐
Clear before ANALYZE and SHOCK	☐
Immediately resume compressions after shock (<10sec)	☐
Appropriate cycles Drug-Rhythm check/Shock-CPR	☐
Administer appropriate drugs and doses	☐
3. Recognize non-shockable arrest early and verbalize potential reversible causes of arrest	
Recognize asystole (<30sec)	☐
Verbalizes potential reversible causes of arrest (H's and T's)	☐
Administer appropriate drug(s) and doses	☐
Immediately resumes CPR after rhythm checks (<10sec)	☐
5. Perform effective team dynamics	

Closed-loop communication	☐
Clear messages	☐
Clear roles and responsibilities	☐
Knowing one's limitations	☐
Knowledge sharing	☐
Constructive intervention	☐
Reevaluation and summarizing	☐
Mutual respect	☐

VII. Set-up

- Monitor (ECG, NBP, SpO2)
- Defibrillator, CPR cart with airway devices, oxygen flowmeter, troponin I kit
- Angio needle, IV line set, drugs: NS10, epinephrine, amiodarone, calcium gluconate, sodium bicarbonate, glucose, insulin, aspirin, nitroglycerin, morphine
- Prehospital EMS ECG rhythm strip, ED 12- leads ECG, portable X-ray, ABG data presented on the LCD monitor
- Pulseless arrest algorithm on the wall
- SimMan with sweating

VIII. Debriefing plan

- use the evaluation results of checklist above