

# Electrical storm

## Section I: Scenario Demographics

Scenario Title:	Electrical Storm		
Date of Development:	(27/12/2015) Revised 01/11/22		
Target Learning Group:	Juniors (PGY 1 – 2)	Seniors (PGY ≥ 3)	All Groups

## Section II: Scenario Developers

Scenario Developer(s):	P.Dieckmann & M. Rall
Affiliations/Institution(s):	TuPASS Germany
Contact E-mail (optional):	Peter.dieckmann@med.uni-tuebingen.de

## Section III: Curriculum Integration

### Learning Goals & Objectives

Educational Goal:	To expose learners to the management of refractory VF (electrical storm)
CRM Objectives:	Effectively lead a code with multiple team members
Medical Objectives:	<ol style="list-style-type: none"> <li>1. Manage cardiac arrest with standard ACLS principles</li> <li>2. Identify and appropriately manage electrical storm</li> <li>3. Initiate appropriate post-arrest care</li> </ol>

### Case Summary: Brief Summary of Case Progression and Major Events

A 55-year-old male is brought to the emergency department with absent vital signs. He collapsed at his office after complaining of feeling unwell. CPR was started by a colleague and continued by EMS. He received 3 shocks by an AED. His downtime is approximately 10 minutes. The team is expected to perform routine ACLS care. When the patient remains in VF despite ACLS management, the team will need to consider specific therapies, such as iv beta blockade or dual sequential shock, to abort the electrical storm.



# Electrical storm

## References

Marx, J. A., Hockberger, R. S., Walls, R. M., & Adams, J. (2013). *Rosen's emergency medicine: Concepts and clinical practice*. St. Louis: Mosby.

Sharif, S, Owen JJ.  $\beta$ -Blockers for refractory ventricular fibrillation in cardiac arrest. *CanadiEM* (2017). < <https://canadiem.org/beta-blockers-in-cardiac-arrest/>>

<https://www.coreultrasound.com/uotw-37-answer/>. Accessed 13 July 2022.

## Section IV: Scenario Script

### A. Clinical Vignette: To Read Aloud at Beginning of Case

Arrest arriving in 1 minute. Doctor to resuscitation room STAT.

Paramedic report: *"This is a 55 year old male we picked up at an office tower down the street. Apparently, he was complaining of feeling unwell all morning and then collapsed at lunch. A colleague started CPR and we were called. The AED delivered 3 shocks. His colleagues say he's healthy and they're unsure about meds or allergies. His boss called his wife and she's on her way."* CPR is ongoing.

### B. Scenario Cast & Realism

Patient:	Computerized Mannequin	Realism: <i>Select most important dimension(s)</i>	Conceptual
	Mannequin		Physical
	Standardized Patient		Emotional/Experiential
	Hybrid		Other:
	Task Trainer		N/A
Confederates	Brief Description of Role		
Nurse	To assist at bedside, cue team on patient's status PRN		



## Electrical storm

## C. Required Monitors

<b>EKG Leads/Wires</b>	<b>Temperature Probe</b>	Central Venous Line
<b>NIBP Cuff</b>	<b>Defibrillator Pads. X2</b>	Capnography
<b>Pulse Oximeter</b>	Arterial Line	Other:

## D. Required Equipment

<b>Gloves</b>	Nasal Prongs	Scalpel
<b>Stethoscope</b>	Venturi Mask	Tube Thoracostomy Kit
<b>Defibrillator</b>	Non-Rebreather Mask	Cricothyroidotomy Kit
<b>IV Bags/Lines</b>	<b>Bag Valve Mask</b>	Thoracotomy Kit
<b>IV Push Medications</b>	<b>Laryngoscope</b>	Central Line Kit
PO Tabs	<b>Video Assisted Laryngoscope</b>	Arterial Line Kit
Blood Products	<b>ET Tubes</b>	Other:
<b>Intraosseous Set-up</b>	<b>LMA</b>	Other:

## E. Moulage

None

## F. Approximate Timing

Set-Up:	5 min	Scenario:	15 min	Debriefing:	20 min
---------	-------	-----------	--------	-------------	--------



# Electrical storm

## Section V: Patient Data and Baseline State

A. Patient Profile and History			
Patient Name: Michael Johnson		Age: 55	Weight: 70kg
Gender: <b>M</b> F		Code Status: Full Code	
Chief Complaint: Cardiac Arrest			
History of Presenting Illness: Feeling unwell and collapsed at lunch			
Past Medical History:	Unknown	Medications:	Unknown
Allergies: Unknown			
Social History: Works at an office, all else unknown			
Family History: Unknown			
Review of Systems:	CNS:	GCS 3	
	HEENT:	Nil	
	CVS:	VF on monitor; patient pulseless	
	RESP:	O2 sat 78% with CPR	
	GI:	Nil	
	GU:	Nil	
	MSK:	Nil	INT:
B. Baseline Simulator State and Physical Exam			
No Monitor Display		Monitor On, no data displayed	Monitor on Standard Display
HR: /min 0/min	BP: 0	RR: 0/min	O <sub>2</sub> SAT: 78%
Rhythm:	T:35.6 °C	Glucose: 6.2mmol/L	GCS: 3 (E1 V 1 M1)
General Status: Obtunded			
CNS:	<b>Pupils dilated at 7mm bilaterally, not reactive to light</b>		



# Electrical storm

HEENT:	Nil acute		
CVS:	Inaudible heart sounds		
RESP:	Good air entry with bagging		
ABDO:	Soft, non-distended		
GU:	Nil acute		
MSK:	Not moving any limbs	SKIN:	<b>Pale, mottled</b>

## Section VI: Scenario Progression

Scenario States, Modifiers and Triggers			
Patient State	Patient Status	Learner Actions, Modifiers & Triggers to Move to Next State	
<b>1. Baseline State</b> Rhythm: VF HR: 0/min BP: 0/0 RR: 0/min O <sub>2</sub> SAT: 78% with CPR T: 35.6 °C ETCO <sub>2</sub> :20	Obtunded, non-responsive	<u>Learner Actions</u> <ul style="list-style-type: none"> <li>- High quality CPR</li> <li>- Monitors and Defibrillator</li> <li>- IV access</li> <li>- BVM</li> <li>- Defibrillate VF as per ACLS</li> <li>- +/- Bedside Echo</li> <li>- Give 1mg Epi q3-5 minutes</li> <li>- Amiodarone as per ACLS</li> <li>- ± Bicarbonate</li> <li>- Give IV fluid bolus</li> <li>- Labs including extended lytes, VBG, lactate, troponin</li> <li>- ± Consider intubation or LMA</li> </ul>	<u>Modifiers</u> <i>Changes to patient condition based on learner action</i> <ul style="list-style-type: none"> <li>- Patient remains in VF regardless of defibrillation attempts or any other treatments</li> </ul> <u>Triggers</u> <i>For progression to next state</i> If defibrillated x4, amiodarone given x2 → <b>2. Refractory VF</b>
<b>2. Refractory VF</b>  Unchanged		<u>Learner Actions</u> <ul style="list-style-type: none"> <li>- Shock with Paddles</li> <li>- Double-Sequential Defibrillation</li> <li>- β-Blocker (Esmolol)</li> <li>- ECMO (not available)</li> <li>- ± Lidocaine</li> <li>- ± Magnesium (1-2 grams)</li> <li>- ± Bicarbonate (1 amp)</li> <li>- ± Calcium Chloride (1 amp)</li> </ul>	<u>Modifiers</u> If learners not yet considering tailored refractory VF treatments, <b>RN to cue at state onset</b> "isnt' there a different medication you can give? Or some weird way of shocking?" <u>Triggers</u> <ul style="list-style-type: none"> <li>- Esmolol given, shock with paddles or double sequential defib →</li> </ul>



# Electrical storm

			<b>3. ROSC</b> - If none of above done after 6 defibs → <b>4. Asystole</b>
<b>3. ROSC</b> <b>HR: 110</b> <b>BP :100/60</b> <b>RR:12 (intubated)</b> <b>O2SAT: 90%</b> <b>ETCO2: 38</b>	Patient's colour improves	<u>Learner Actions</u> - EKG (12 and 15 lead) - Call Cath lab/ICU/CCU - Targeted temperature management - Optimize hemodynamics - Intubate if not yet done - Post-Intubation CXR - Initiate sedation	<u>Modifiers</u> - EKG -> STEMI  <u>Triggers</u> - All actions complete or 15 min→ (End of Case- "cath lab is ready")
<b>4. Asystole</b> <b>Rhythm: Asystole</b> <b>HR: 0</b> <b>ETCO2 → 5</b>	Non responsive	<u>Learner Actions</u> - Epinephrine 1mg q3-5min - ± Bicarbonate - ± Calcium chloride - ± Consider ending resuscitation	<u>End Case PRN</u>

## Section VII: Supporting Documents, Laboratory Results, & Multimedia

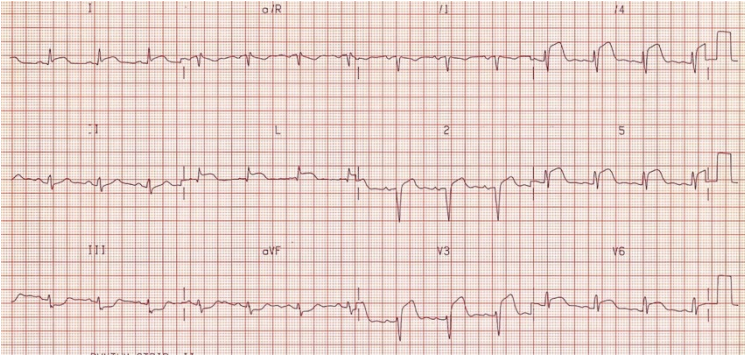
<b>Laboratory Results</b>
No labs back



# Electrical storm

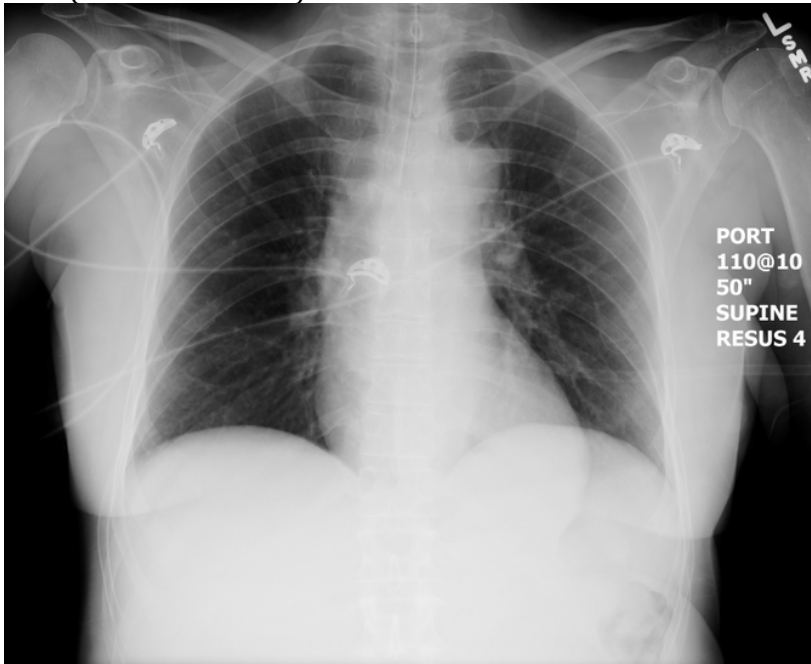
## Images (ECGs, CXRs, etc.)

### EKG: Anterior STEMI



Source: <https://lifeinthefastlane.com/wp-content/uploads/2012/01/anterolateral.jpg>

### CXR (Post-Intubation)



Source: <https://emcow.files.wordpress.com/2012/11/normal-intubation2.jpg>

# Electrical storm

## Ultrasound Video Files (if applicable)

Ventricular Fibrillation on Echo

<https://www.coreultrasound.com/uotw-37-answer/>





# Electrical storm

## Section VIII: Debriefing Guide

General Debriefing Plan			
Individual	Group	With Video	Without Video
<b>Objectives</b>			
Educational Goal:	To expose learner to the management of refractory VF (electrical storm)		
CRM Objectives:	Effectively lead a code with multiple team members		
Medical Objectives:	<ol style="list-style-type: none"> <li>1. Manage cardiac arrest with standard ACLS principles</li> <li>2. Identify and appropriately manage electrical storm</li> <li>3. Initiate post-arrest care</li> </ol>		
<b>Sample Questions for Debriefing</b>			
<ol style="list-style-type: none"> <li>1. What is the definition of refractory ventricular fibrillation?</li> <li>2. How is refractory ventricular fibrillation managed?</li> <li>3. How do you perform double-sequential defibrillation?</li> <li>4. What are the indications and contraindications to thrombolysis?</li> <li>5. How did you feel the communication was with the team leader and the rest of the team?</li> <li>6. How did your team handle this complex case? Were you all aware what the plan was?</li> </ol>			
<b>Key Moments</b>			
Recognition of refractory VF			
Initiating adjunctive therapies (i.e. dual sequential defibrillation, $\beta$ -Blockers)			
Post-ROSC → initiate targeted temperature management, Order EKG and call Cath Lab			

