

# Sports Trauma-Induced Cardiac Arrest

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## Objectives

1. Discuss cardiac arrest related to sports trauma
2. Describe the mechanism of injury, signs and symptoms, and management
3. Discuss planning to succeed with these injuries

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## Disclosures

- I am a trauma surgeon
  - Not a pre-hospital provider
- I work in level 1 and level 3 trauma centers
- We receive research funding from the NIH and DOD

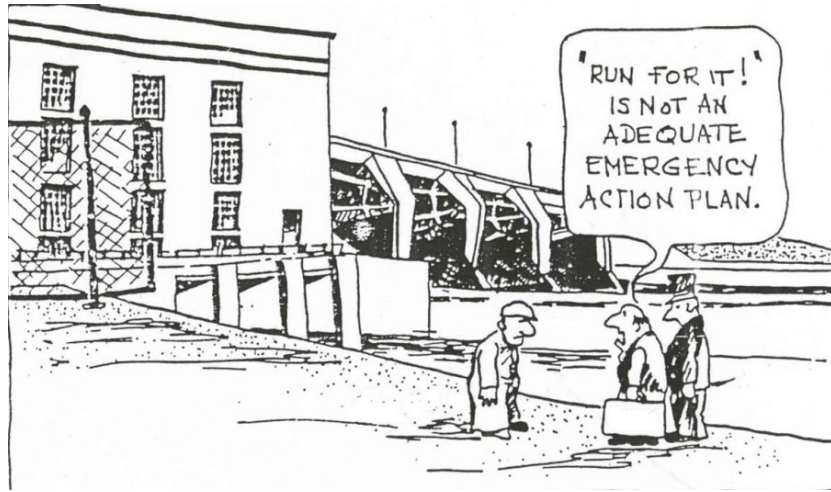


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“If You Fail to Plan, You Are Planning to Fail”  
— Benjamin Franklin

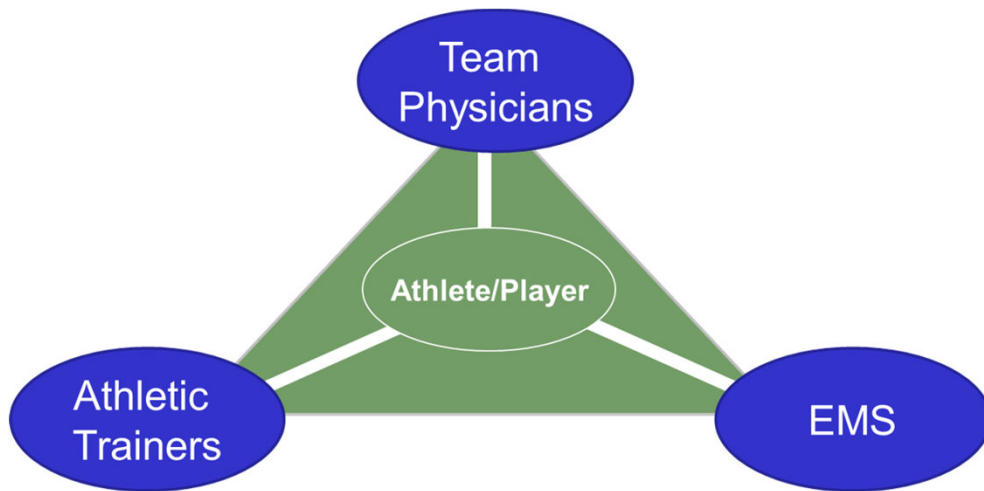
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### Emergency Action Plan



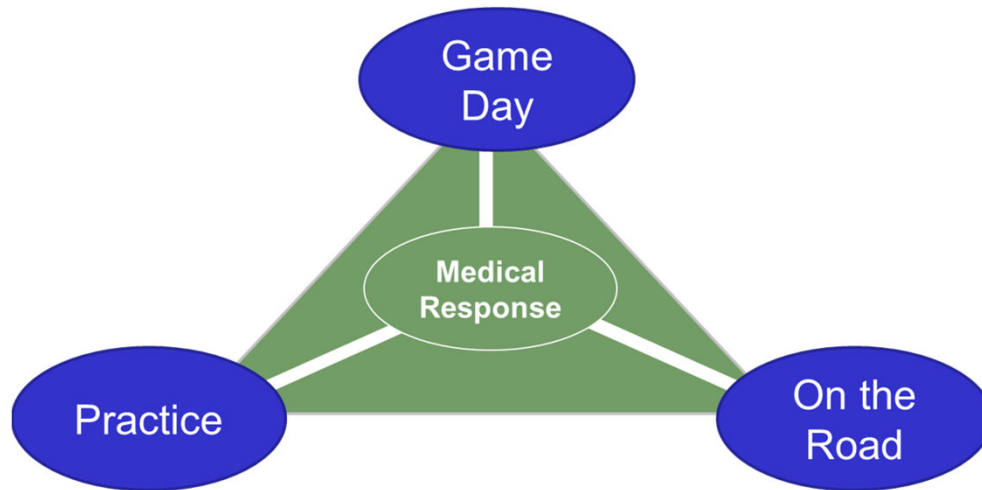
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### Athlete Emergency Triangle



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## Be prepared in every location



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## Emergency Action Plan

Personnel/Roles  
 Communication  
 Equipment  
 Transportation  
 Venue Directions (Map)  
 Non-Medical Emergencies  
 Documentation



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## Prepare Your People

Athletic Trainers  
 Coaches and Teachers  
 EMT/Paramedics  
 Physicians  
 Bystanders/Good Samaritans  
  
 Game Day vs. Practice



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## Prepare Your Resources

What equipment will be available?

- AED
- EpiPen
- First Aid
- Bleeding control
- Immobilization devices
- Cold water immersion bath
- Equipment removal equipment

Who is responsible for maintaining/checking equipment?



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## Prepare Your Environment



### Ambulance Location

On Site

High impact sports

Long response times

Dedicated to event or standing-by?

Available for other 911 calls?

Communication

Who goes with the injured player?

Who stays back to provide coverage?

### Predetermined destination(s)

Trauma/Trauma Center

Orthopedic Injuries

Other Emergencies

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## Prepare Your Mind

Airway plan

Breathing plan

Cardiac plan

Circulation plan

Concussion plan

Cervical Spine Injury plan

Disaster plan

Diabetic plan



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Head  
Heart/Chest  
Heat  
Hemoglobin  
High C-spine



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## Patient #1

- 19 year old
- College basketball game
- Fighting for a rebound
- To the court, hard
- Does not rise



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## Advanced Sports Life Support




- Airway
- Breathing
- Cardiac
- Circulation/Trauma
- Disability
  - Cervical Spine
  - Concussion/Neuro
- Conditions/Environment
- Crisis Management/Disaster
- Diabetes

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## Approach to the Collapsed / “Sick” Athlete

**Mechanism of Injury/Illness**



**Traumatic**




**Non-Traumatic**

“Any athlete who collapses without obvious head trauma and is unresponsive on the field of play should be assumed to be in SCA until proven otherwise”.

Sudden cardiac arrest on the field of play: turning tragedy into a survivable event. *North Heart J.* 2018;Mar;26(3):115-119.  
 PMID: 29411289.


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## Non-Traumatic Sudden Cardiac Arrest in Athletes

- Usually first sign of illness
- Posturing, increased tone
- myotonic jerks, “seizure” in 50%
- Breathing spontaneously, abdominal gasping
- Eyes open

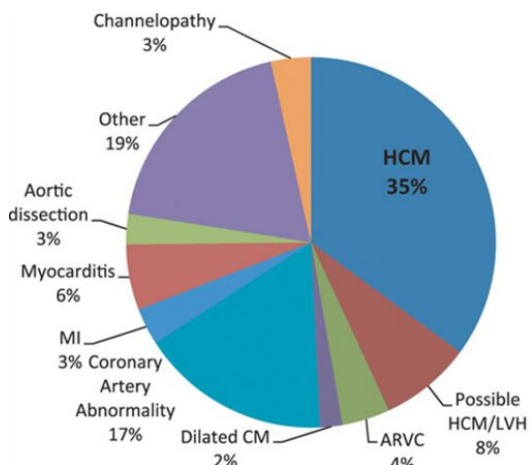


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## Sudden Cardiac Arrest in Athletes

- Leading medical cause of mortality in athletes
- 1:50,000 AY in college athletes
- 1:50-80,000 AY in high school athletes
- 100-150 deaths/year
- males, basketball players, soccer players
- 1 in 9000 AY NCAA basketball players



| Condition                   | Percentage |
|-----------------------------|------------|
| HCM                         | 35%        |
| Other                       | 19%        |
| Dilated CM                  | 17%        |
| Possible HCM/LVH            | 8%         |
| ARVC                        | 4%         |
| Myocarditis                 | 6%         |
| Aortic dissection           | 3%         |
| MI                          | 3%         |
| Coronary Artery Abnormality | 3%         |
| Channelopathy               | 3%         |

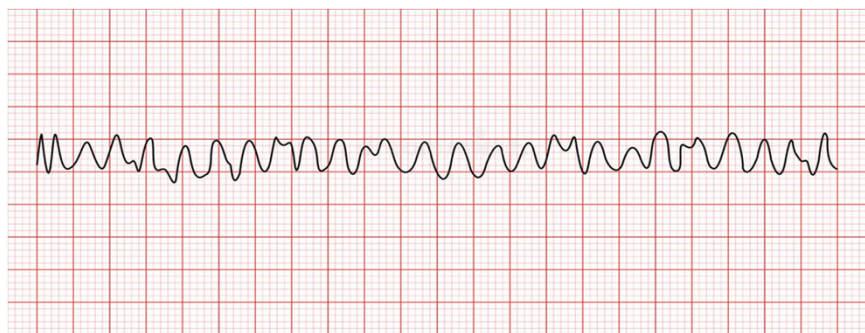
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**Table** Causes of Common Cardiac Death in Young Athletes

| Structurally Normal Heart                             | Structurally Abnormal Heart                       |
|---|---|
| Brugada syndrome                                      | Hypertrophic cardiomyopathy                       |
| Long QT syndrome                                      | Arrhythmogenic right ventricular cardiomyopathy   |
| Catecholaminergic polymorphic ventricular tachycardia | Dilated cardiomyopathy                            |
| Commotio cordis                                       | Left ventricular noncompaction                    |
| Other channelopathies                                 | Congenital abnormalities of the coronary arteries |
| Electrolyte abnormalities                             | Marfan syndrome                                   |
| Wolf Parkinson White syndrome                         | Valvular heart disease                            |
|   | Myocarditis                                       |
|   | Coronary artery disease (athletes >35 years old)  |

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## Final Common Pathway



- Majority of SCD events in athletes are due to malignant arrhythmias
- Sustained ventricular tachycardia (VT) or ventricular fibrillation (VF)

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## Intervention

- CPR should commence at the site of athlete arrest, beginning with chest compressions in the case of a witnessed collapse (do not move patient)
- CPR should continue uninterrupted until an AED is applied and begins to analyze the athlete's cardiac rhythm.
- If defibrillation is provided, chest compressions should resume immediately after shock delivery



Sudden cardiac arrest on the field of play: turning tragedy into a survivable event. *Neth Heart J.* 2018 Mar;26(3):115-119. PMID: 29411289;

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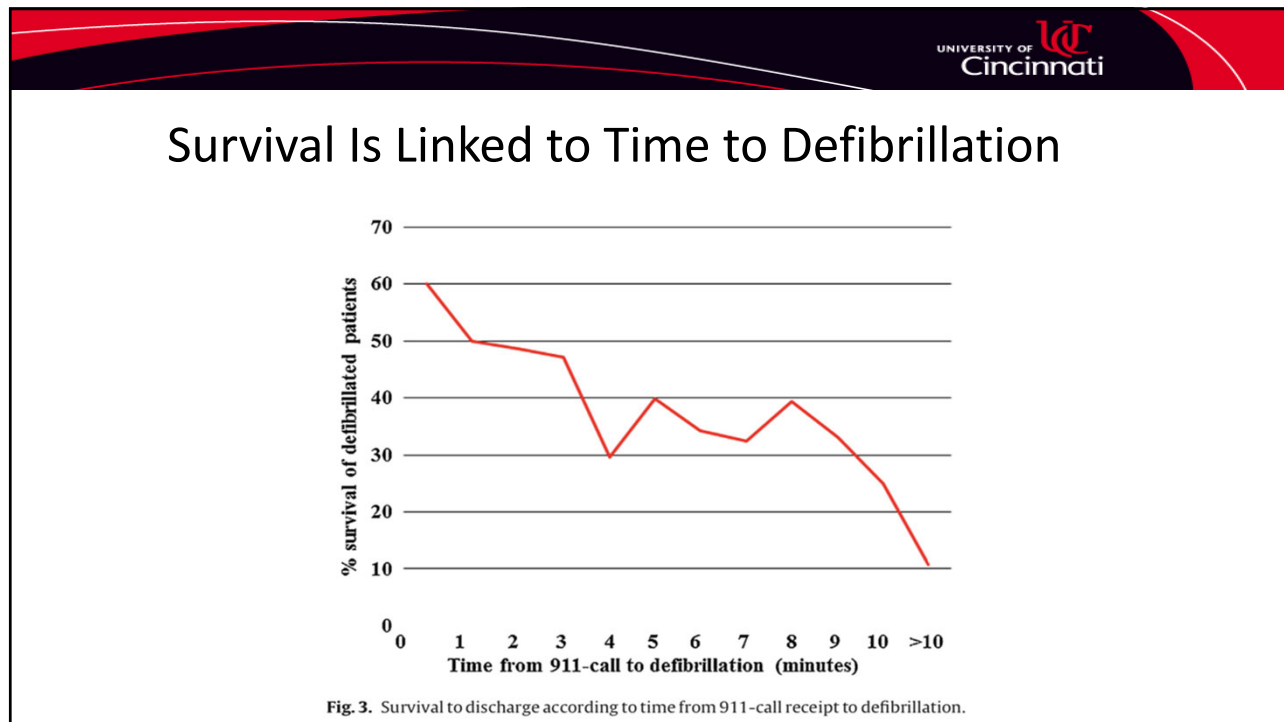
## Outcomes from sudden cardiac arrest in US high schools: a 2-year prospective study from the National Registry for AED Use in Sports

- 2100 high schools
- 59 cases of SCA >> 26 students/33 adults

► Survival rates are higher in schools with an established emergency action plan for SCA versus those without (79% vs 44%; OR 4.6) and if an onsite AED is used versus an offsite AED provided by emergency medical services (80% vs 50%; OR 4.0).

Drezner JA, Toresdahl BG, Rao AL, *et al* Outcomes from sudden cardiac arrest in US high schools: a 2-year prospective study from the National Registry for AED Use in Sports *British Journal of Sports Medicine* 2013;47:1179-1183.

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## Patient #2

- 19 year old
- College basketball game
- Fighting for a rebound
- To the court, hard
- Does not rise

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## Patient #2

Awake, complains of severe  
left chest pain

Breathing is labored

Tachycardic, thready pulse



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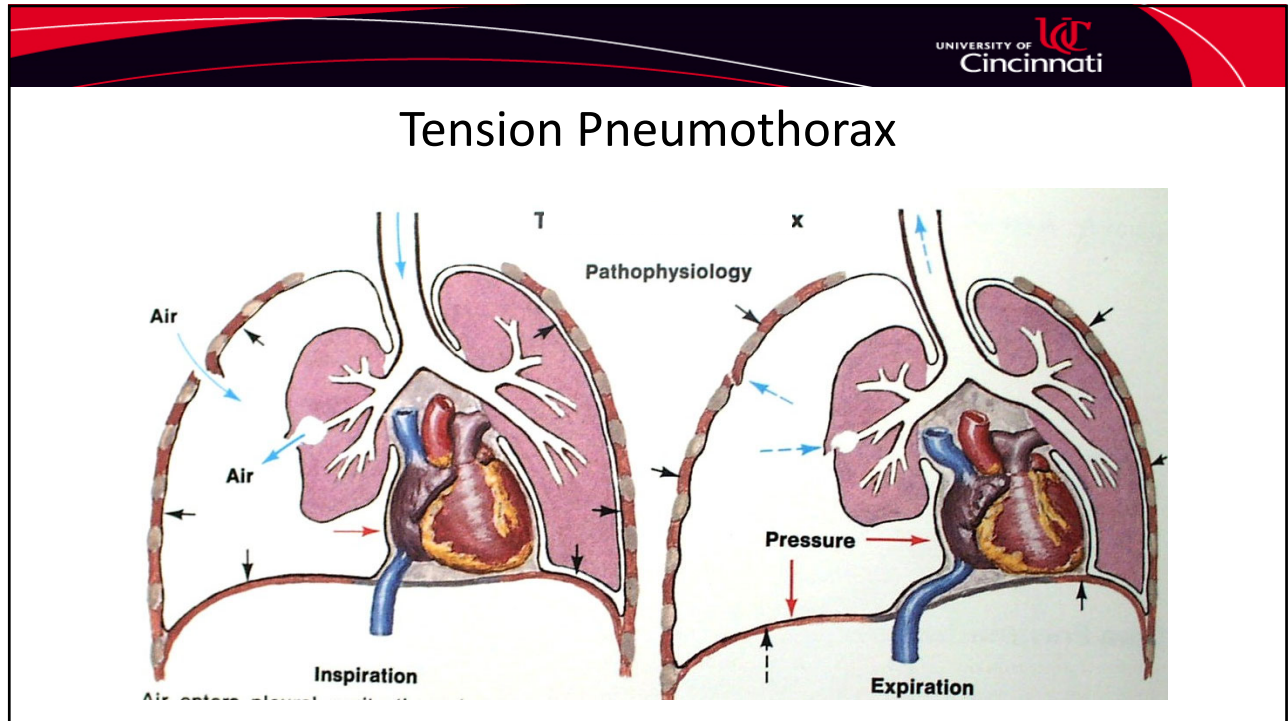
## Patient #2

In ambulance:

- Hypoxic
- Tachycardic
- Hypotensive
- Loses pulse



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## Why is this a problem?

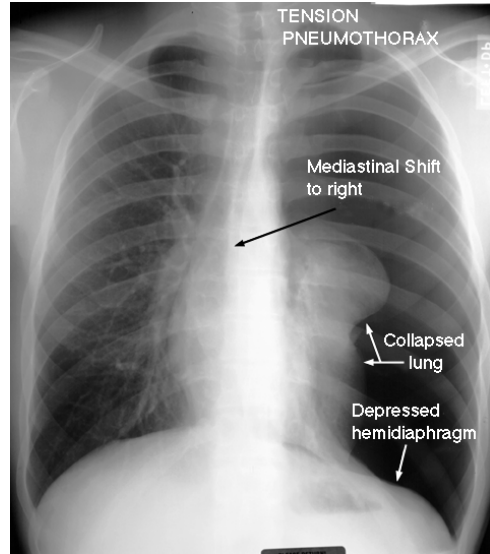
Cardiac output = HR x Stroke Volume

If stroke volume is 0, HR is irrelevant

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## Signs and Symptoms

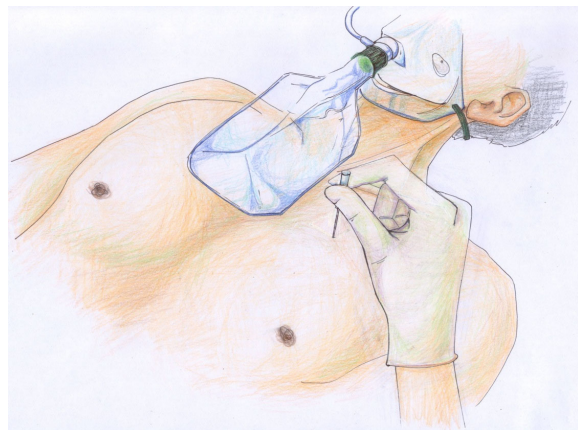
- Respiratory distress
- Distended neck veins
- Unilateral ↓ in breath sounds
- Hyperresonance
- Tracheal deviation
- Cyanosis, late



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## Tension Pneumothorax

- Clinical diagnosis
- Treat with needle decompression
  - If in doubt, re-needle
  - Don't go too medial
- Chest tube for definitive treatment



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## Patient #3

- 24 yo hockey player
- Hockey puck to the neck
- To the ice, hard
- Does not rise



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## Patient #3

Upon evaluation:

- Hoarseness
- Can't swallow
- Crepitus
- Loss of thyroid prominence



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## Laryngeal Fracture

### Supraglottic:

- epiglottic hematoma/ avulsion, hyoid bone fracture, thyroid cartilage fracture, arytenoid dislocation or degloving, endolaryngeal edema
- **Airway obstruction**

### Glottic injuries:

- hoarseness generally associated with fracture of thyroid cartilage resulting in vocal cords edema, endolaryngeal lacerations, avulsion of vocal cord from the anterior commissure

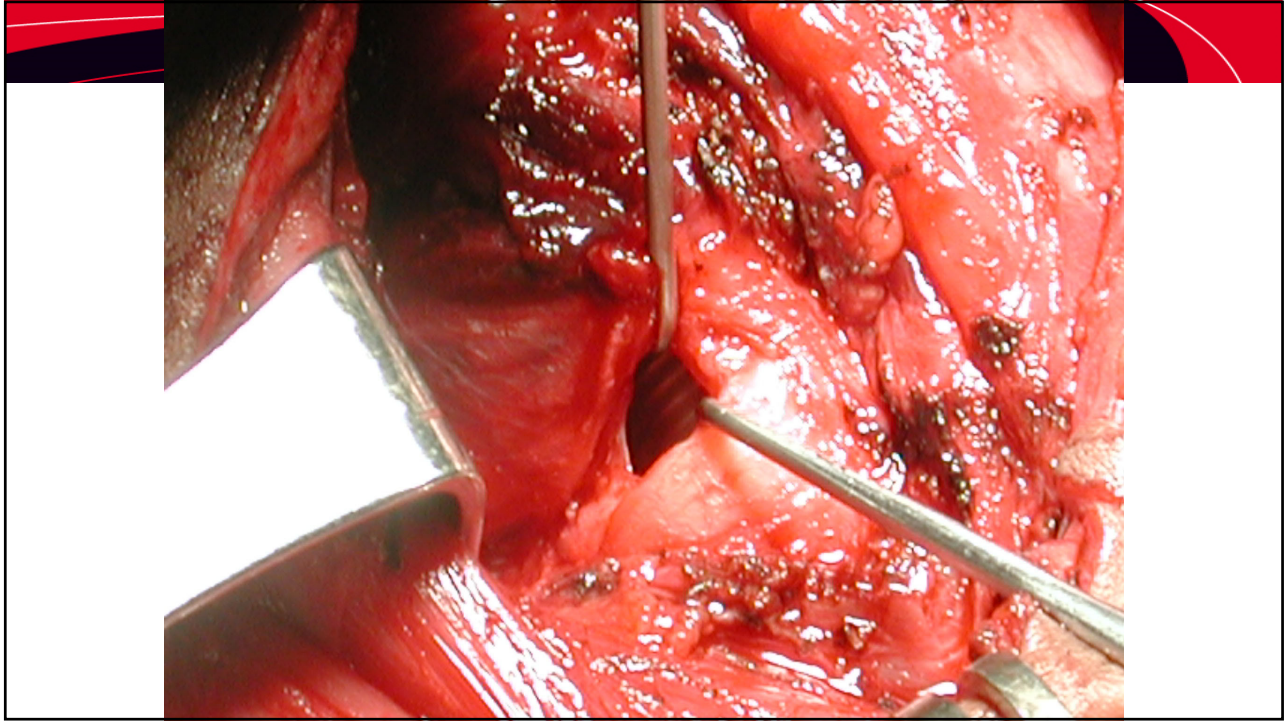
### Subglottic

- Cricoid cartilage and cervical trachea involved causing profound airway compromise.
- Complete cricotracheal disruption with **acute airway obstruction** can cause rapid death unless the airway stabilizes rapidly

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# Patient #4

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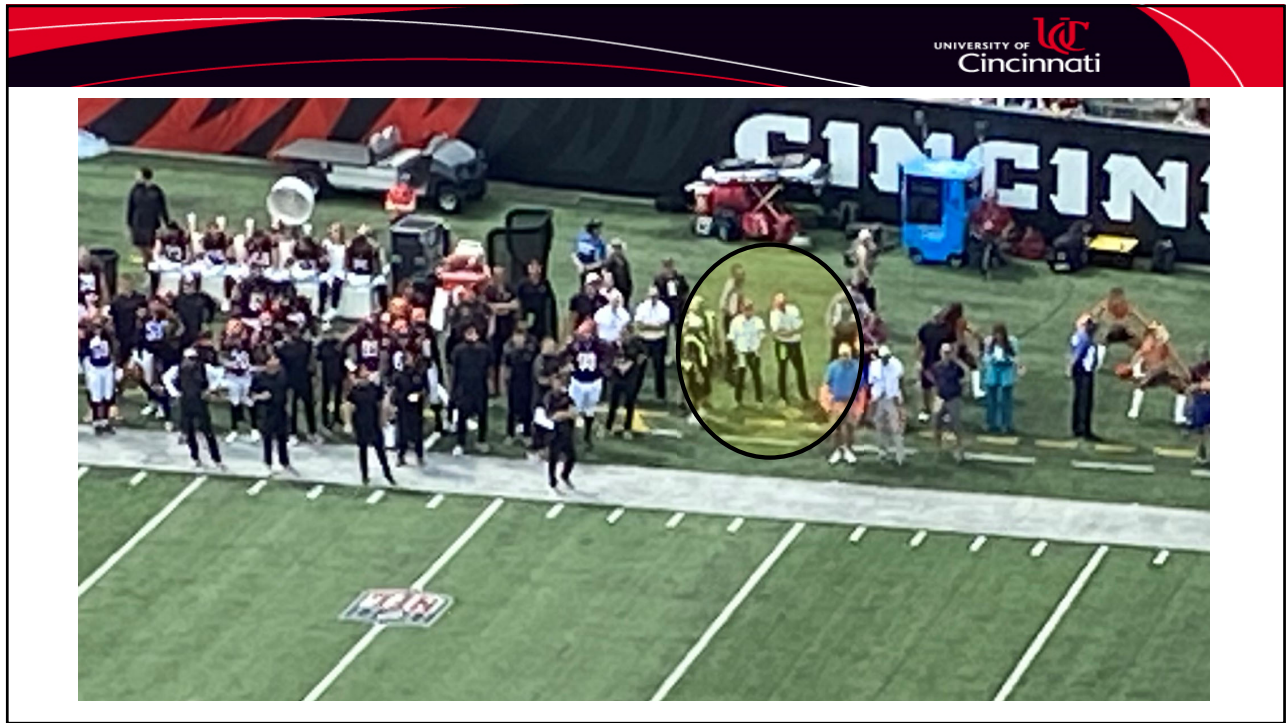
# Patient #4



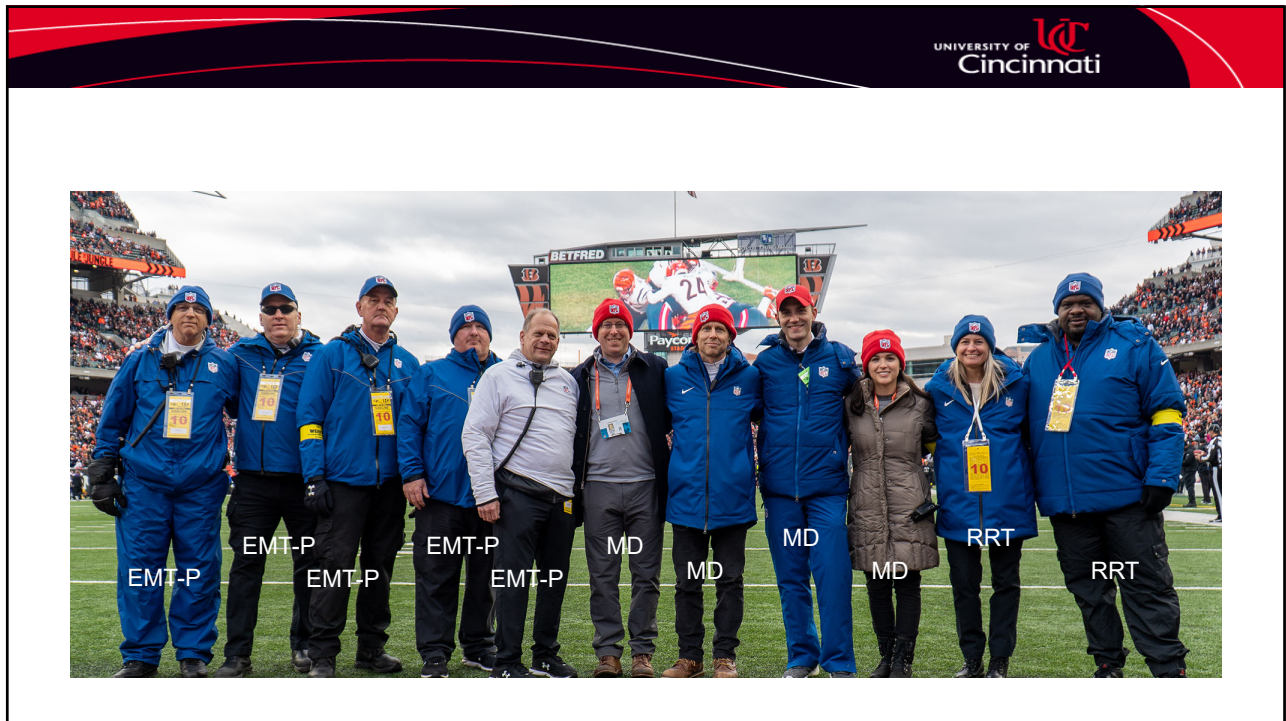
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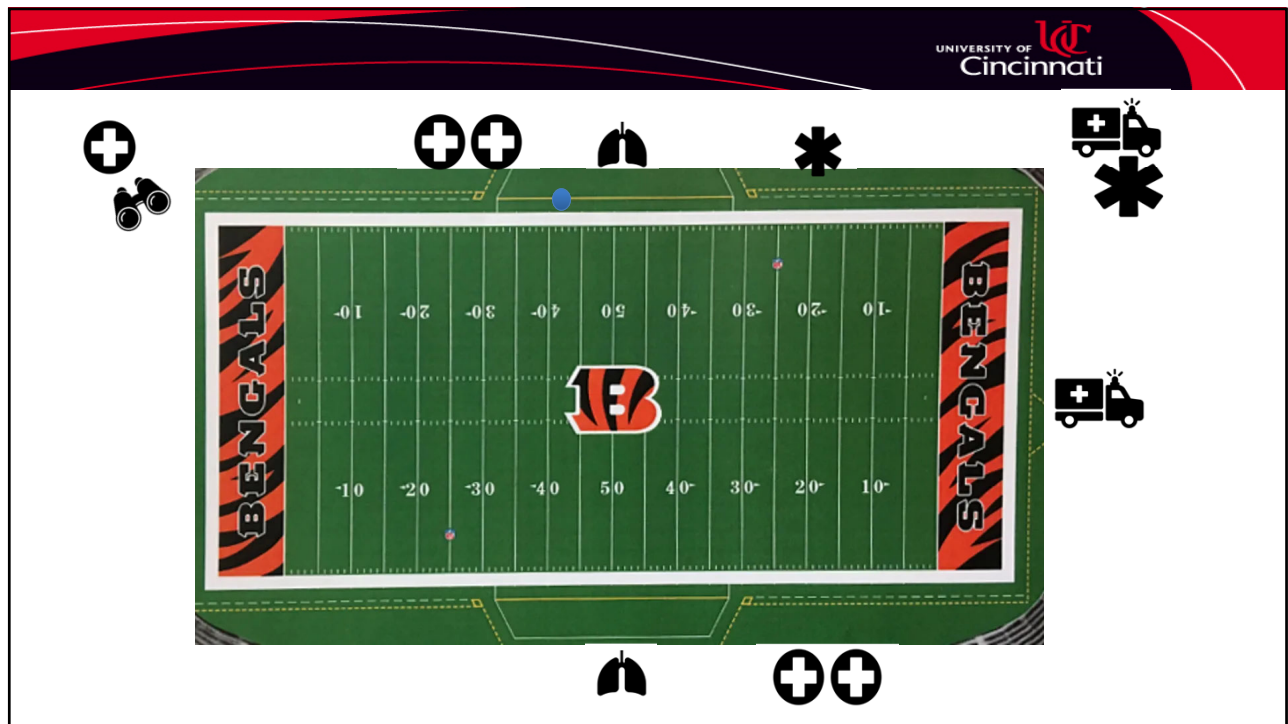
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2055 Injury

2055 First medical contact  
Bills' trainers

CPR

Shock

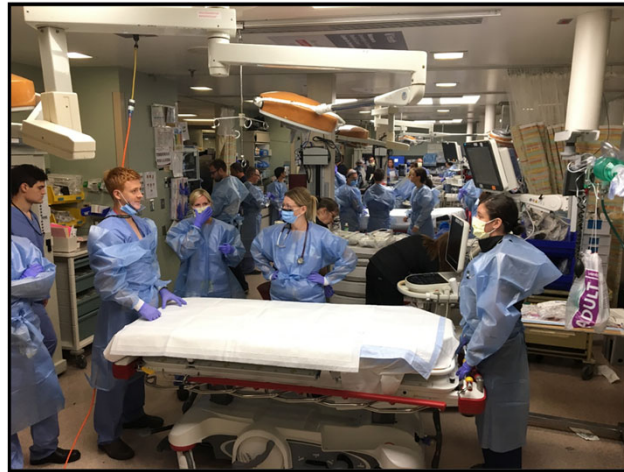
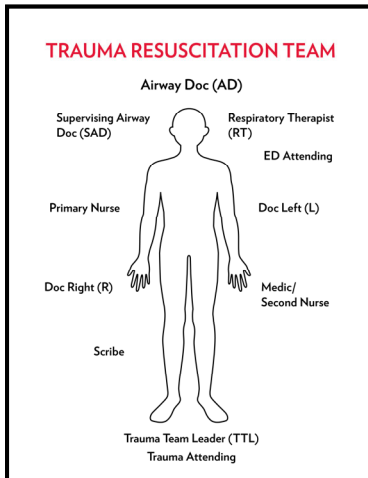
ROSC

2125 Ambulance departs  
stadium

Trauma Stat activation

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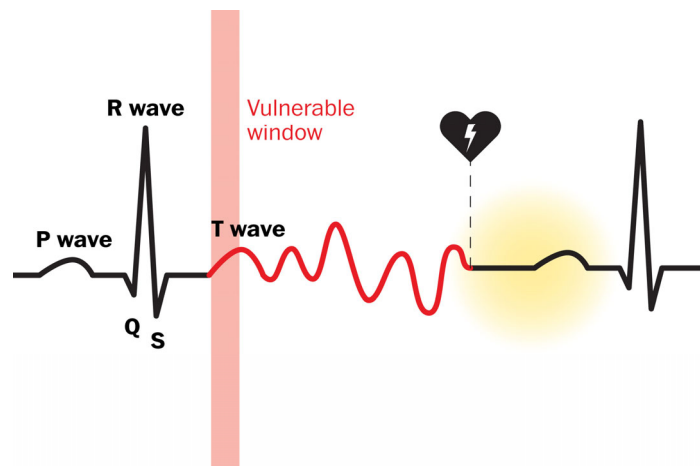
## Hospital Team Response




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
## Comotio Cordis

- 10-20 cases/year in US
- Baseball, hockey, lacrosse
- Blow to precordial region
- 40 millisecond window in the cardiac electrical cycle
- Sudden rise in intracavitary pressure disrupts normal heart electrical activity, leading to VF
- 97% fatal if not treated within three minutes
- CPR + AED = 58% survival




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 **Damar Hamlin** ✓  
@HamlinIsland

GAMETIME!!! @BuffaloBills ❤️




12:58 PM · Jan 8, 2023 · 23M Views

62.2K Retweets 5,728 Quote Tweets 709.5K Likes

**Bills safety Damar Hamlin released from Cincinnati hospital, returns to Buffalo**

Published: Jan 09, 2023 at 03:21 PM

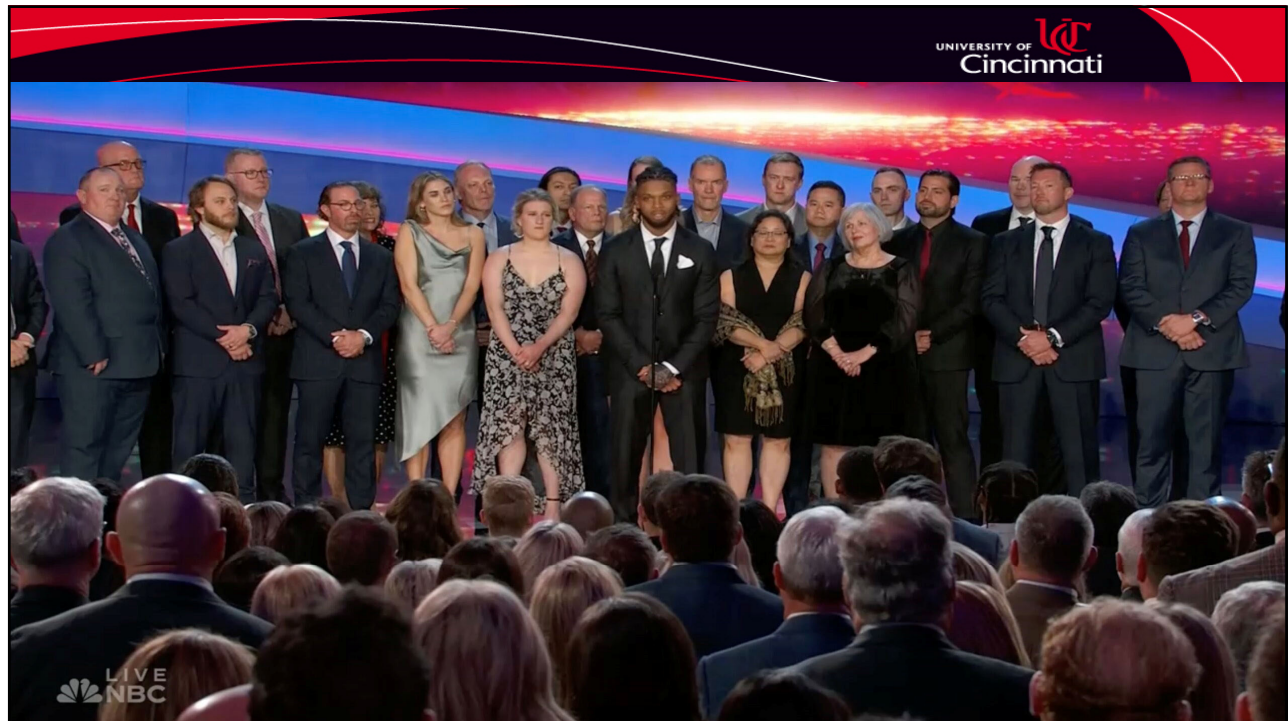
Around the NFL Staff  
NFL.com



**BREAKING NEWS**  
Damar Hamlin has been released and is returning to Buffalo

Bills safety [Damar Hamlin](#) has been released from the University of Cincinnati Medical

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## Parting Thoughts

- Patients don't always read the book, but physiology doesn't lie
- Mechanism predicts injury pattern, which predicts pathophysiology, which predicts therapeutic needs
- Patients may have more than one issue
- Protocols and ATLS help keep us all out of trouble
- Plan, prepare, practice, debrief/plan
- It takes a village...



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**We don't rise to the level of our expectations.  
We fall to the level of our training.**



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**We don't rise to the level of our expectations.  
We fall to the level of our training.**



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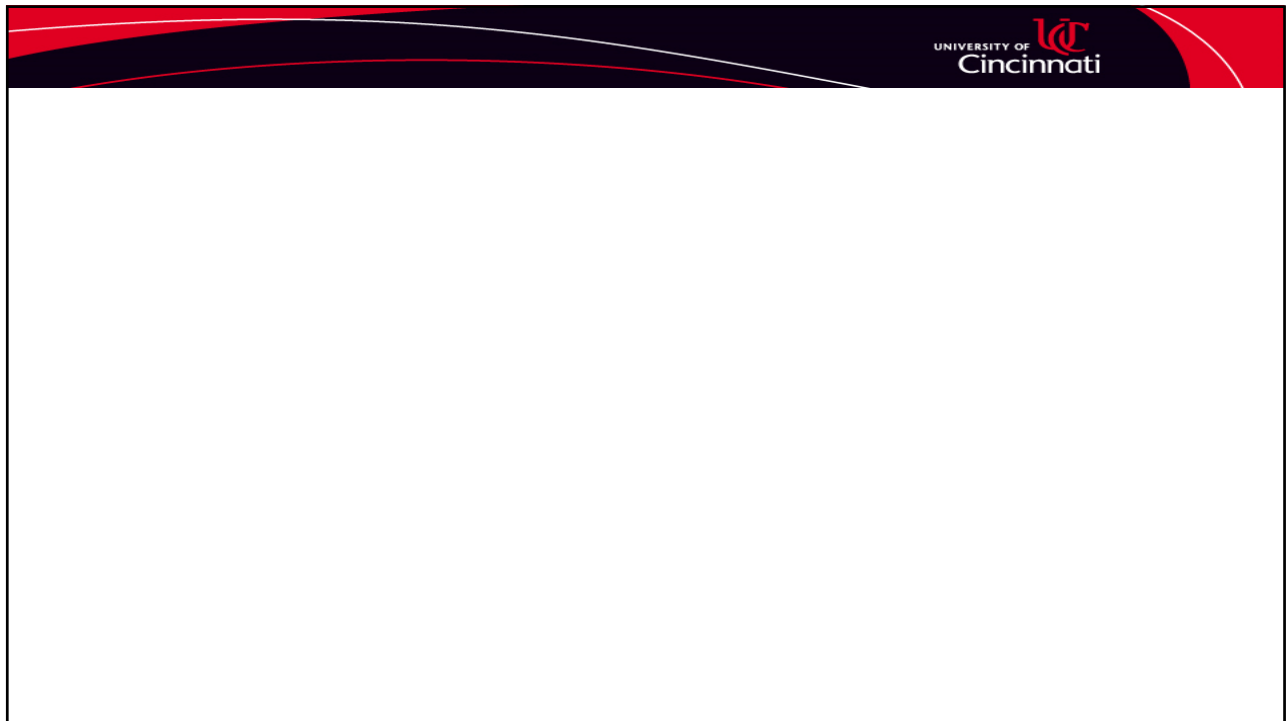
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