Goals

1. Discuss approach, diagnosis, and pre-hospital management of collapsed athlete
   • Differential-guided algorithm
   • Example cases

2. Recognize importance of early AED use in collapsed athlete

3. Recognize importance of mental status in differential diagnosis
The Collapsed Athlete: Approach and Pre-hospital Management

- Background
- Diagnostic Algorithm
- Example cases
- Summary
- Acknowledgements
Background
National High School Catastrophic Injuries 1982-2011

Mueller, FO & Cantu, RC. Catastrophic sports injury research: 29th annual report. www.unc.edu/depts/nccsi. Used with permission
Differential Diagnosis for Collapsed Athlete

- **CNS**: Seizure, Toxic ingestion, Cerebrovascular accident, Concussion
- **Cardiac**: Arrhythmia
- **Respiratory**: Asthma, Hemothorax, Foreign body
- **Musculoskeletal**: Trauma
- **Metabolic**: Hypoglycemia, Hyponatremia, Heat exhaustion/stroke, Hypothermia, Ingestion
- **Allergic**: Anaphylaxis

Background

• Sports-related collapses are usually witnessed (99.8% if in public sports facilities)

• Bystander CPR variably initiated (30.7%)
  • Associated with survival to hospital discharge

Causes of Death

- 838 athletes definitive diagnosis in only 24.7%
- Diagnosis rare in those that die on site
  - Cardiac in origin for all 203/207
  - Others: epilepsy, stroke


- US data: Cardiac etiology in 78% of cases

Algorithm
Collapsed Athlete

Immobilize C-Spine

Absent/Unstable Pulse and Respirations

AED

Stable Pulse and Respirations

Normal Mental Status

Abnormal Mental Status
Shockable Rhythm?

Yes
- Vfib/VTach

No
- Cardiac/Respiratory Cause

CPR
Transport
Normal Mental Status

Collapse-in Exercise
- Trauma
- Cardiac
- Anaphylaxis
- Heat-Exhaustion
- Illness-Specific Treatment

Collapse-post Exercise
- Exercise-Associated Collapse
- Oral fluids
  - Elevate Legs
Abnormal Mental Status

- Normal DS, Temp, Na
  - Trauma
  - Seizure
  - Tox
  - CVA
  - Cardiac
  - Exhaustion

- DS<60
  - Hypoglycemia

- Temp>40
  - >103°F
  - Heat Stroke

- Temp<35
  - <95°F
  - Hypothermia

- Na<135
  - Hyponatremia

- Illness-Specific Treatment
- D50 Glucagon
- Rapid Cooling
- Passive External Warming
- Fluid Restrict 3% Saline
Cases
On the news...
Case 1

• 16 yo, 135 kg male with altered mental status after summer football practice

• ABC’s:
  • Open airway with rapid shallow breathing
  • Weak rapid central pulse
  • Burning-up on exam

Adapted from: Fink E, Brandom BW, Torp KD. Pediatric Emergency Care 2006;22(7):510-513
History

- **Allergies:** none
- **Medications:** none
- **PMH:** Sickle cell trait
- **Last PO not reported**
- **Events:** Football practice was minimal contact, collapse was at end, temp was 95 degrees, 90% humidity
Collapsed Athlete

Stable
Pulse and
Respiration

Abnormal Mental Status

Test Blood Sugar, Temp, Sodium

- Trauma
- Seizure
- Tox
- CVA
- Cardiac Exhaustion

- Hypoglycemia
- Heat Stroke
- Hyponatremia
- Hypothermia

Illness-Specific Treatment

D50 Glucagon
Rapid Cooling
Fluid Restrict 3%
Passive External Warming
EMS interventions

• ETT was placed secondary to altered mental status and developing cyanosis

• Cooling measures initiated
  • Ice to axillae and groin

• Vital signs on presentation to local hospital:
  • Ventilated with HR 158, BP 146/103, Rectal temp 40.2°C
Community Hospital Course

- Labs: pH 7.33, base deficit 8.5
  - Serum K 5.9
  - CK 785

- Management:
  - 2l saline infused
  - Continued cooling with NG lavage with iced water, cooling blanket
  - Low urine output after foley placement
Transfer to children’s hospital ICU

- Phone rec’s from medical control:
- Sodium bicarbonate, calcium gluconate, kayexalate enema
- 4l of NS
- 1h of cooling measures
- Rectal temp was 38.0, blood pH and potassium normal
ICU course

- Head CT normal
  - Extubated 18h later

- Rhabdomyolysis and Renal Failure
  - CK 5947 1st hospital day
  - Peak 90,720 IU on 3rd day
  - Myoglobin peaked 66,700 on 4th day hospital day

- Treated with alkalinization and steroids
Follow-up

- **Tox:** comprehensive toxicology screen positive for caffeine
- **Extent of rhabdomyolysis** may have been exacerbated by sickle trait
- **Follow-up:** returned to sports and won a sports scholarship
On the news...
Case 2

- 11-yo previously healthy star player up to bat
- Ball is pitched, striking batter in chest
- Batter starts to run to 1st base when he suddenly collapses
- What next?
On exam...

• A - Patent airway
• B - Irregular breathing
• C - No pulses
• Mental Status: patient is unresponsive
Collapsed Athlete

Absent/Unstable Pulse and Respirations

AED

Shockable Rhythm?

Yes

Vfib/VTach

Cardiac Resp. Cause

No

CPR

Transport
No pulse...

- CPR initiated
- Patient attached to AED
- Shock advised and delivered
- Pulses returned
- Patient transferred to ED
Commotio Cordis: Epidemiology

- Incidence: > 200 confirmed cases since mid-90s
- Young people (mean age 15 yrs)
- Male (95%)
- Athletics (75%)
- Projectiles or blunt bodily contact

Commotio Cordis: What is it?

• Arrhythmic event (ventricular fibrillation)

• Structurally normal heart

Management

- Recognition of pulseless arrest
- CPR
- AED → Defibrillation
- Epinephrine

Outcome

- 25% survival after CPR/defibrillation
- 15 → 35% survival in last decade
  - Increased awareness
  - AED availability
  - Prompt initiation of survival algorithms

- No evidence for increased risk of subsequent arrhythmic events among survivors

Case 3

• 11-yo runs to the batting plate, hunches over, and collapses suddenly

• What next?
On exam...

- A - patient is responsive with muffled sounds
- B - labored breathing; stridor
- C - 1+ pulses; tachycardic
- Mental status: pt is awake, coughing
- Hives on neck and face
Collapsed Athlete

Stable
Pulse and
Respirations

Normal
Mental Status

Collapse
-in
Exercise

Trauma
Cardiac
Anaphylaxis
Heat-
Exhaustion

Collapse
-post
Exercise

Exercise-
Associated
Collapse

Illness-
Specific
Treatment

Oral fluids
Elevate
Legs
Exercise-Induced Anaphylaxis

• > 1000 cases since 1st recognized case report in 1979
• 5 - 15 % of all anaphylactic reactions
• Predominates 2nd or 3rd decade of life
• Frequency of episodes varies from patient to patient


Triggers of EIA

- Exercise
- Jogging
- Aerobics
- Walking

- Hot, humid, or very cold weather

Barg W et al. 2011
EIA Dx

- Clinical dx
- Personal or family hx atopy
- Sxs within 30 minutes of initiating exercise
- R/o food-dependent EIA
  - Wheat gliadin protein
  - Shellfish

Barg W et al. 2011
Goldfam K and CT Silvers. 2012
EIA Sxs

• Similar to anaphylaxis triggered by other factors:
  • Pruritus
  • Urticaria
  • Angioedema
  • LOC
  • GI Sxs

Barg W et al. 2011
Pathophysiology of EIA

- Release of histamines from mast cells
- Some hypotheses include:
  - Increased endogenous endorphins
  - Higher alpha-adrenergic tone
  - Higher serum osmolality from dehydration

Barg W et al. 2011
Goldfam K and CT Silvers. 2012
Management of EIA

- Cessation of exercise
- IM Epinephrine
- Adjuncts:
  - H1 blockers (anti-histamines)
  - H2 blockers (ranitidine)
  - Corticosteroids
  - Bronchodilators

Barg W et al. 2011
Goldfam K and CT Silvers. 2012
Prophylaxis for EIA

- Rx EpiPen
- Avoidance of triggers
- Avoiding exercise for 4 - 6 hrs after food ingestion
- Cetirizine and monteleukast may play a role in prevention in FDEIA in future

Barg W et al. 2011
Goldfam K and CT Silvers. 2012
Take-Home Points

• Systematic approach to the collapsed athlete in the field
  • Assess Pulse/Respirations
  • Assess Mental Status

• Effective CPR

• Early recognition of need for AED

• Use of available resources
Areas for Research and Advocacy

- Little data on nonlethal causes of collapse in young athlete
- Heighten awareness of factors associated with sudden non-traumatic death
  - Preexisting conditions
  - Early training
  - Environmental conditions
  - Hazing
  - Performance enhancement
Methods for Prevention and Improved Treatment

- Encourage sports pre-participation screening:
  - AHA screening not mandated in RI
  - Number of states without increasing

  Glover DW et al. 2007. Evolution in the process of screening US high school student-athletes ... Am J Cardiol 2007;100:1709-1712

- Increase bystander CPR and availability of AEDs

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