

# ***2023 Ironman Conference***

## **What You Need to Know to Work in the Ironman Medical Tent**

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# Ironman Medical Tent



# Overview

- Discuss evaluation of the collapsed Triathlete
  - Define criteria for determining severity of exercise collapse.
  - Review common causes of collapse.
- Review other common problems seen in medical tent
- Outline a general protocol for evaluating athletes in the Ironman Medical tent





# Hawaii Ironman Triathlon - Kona

- Swim 2.4 miles



- Bike 112 miles



- Run 26.2 miles



# Will of the Ironman Athlete Natasha Badman - 2003



**“The notion that courage and esprit de corps can somehow defeat the principals of physiology is not only wrong, it is dangerously wrong.”**

Sir Roger Bannister; 1989

# Exercise Associated Collapse; Signature Injury for Ironman

- Made famous by the Julie Moss collapse and crawl in the 1982 Ironman.
- One of the most dramatic and common problems seen in the medical tent.
- Problems with Na and fluid balance are often the cause.





# Exercise Associated Collapse (Definition)

- Inability to walk unassisted
  - With or without exhaustion, nausea, vomiting or cramps.
  - Body temp may be normal, high or low.
- Excludes orthopedic conditions (ankle sprain, knee injury etc.).





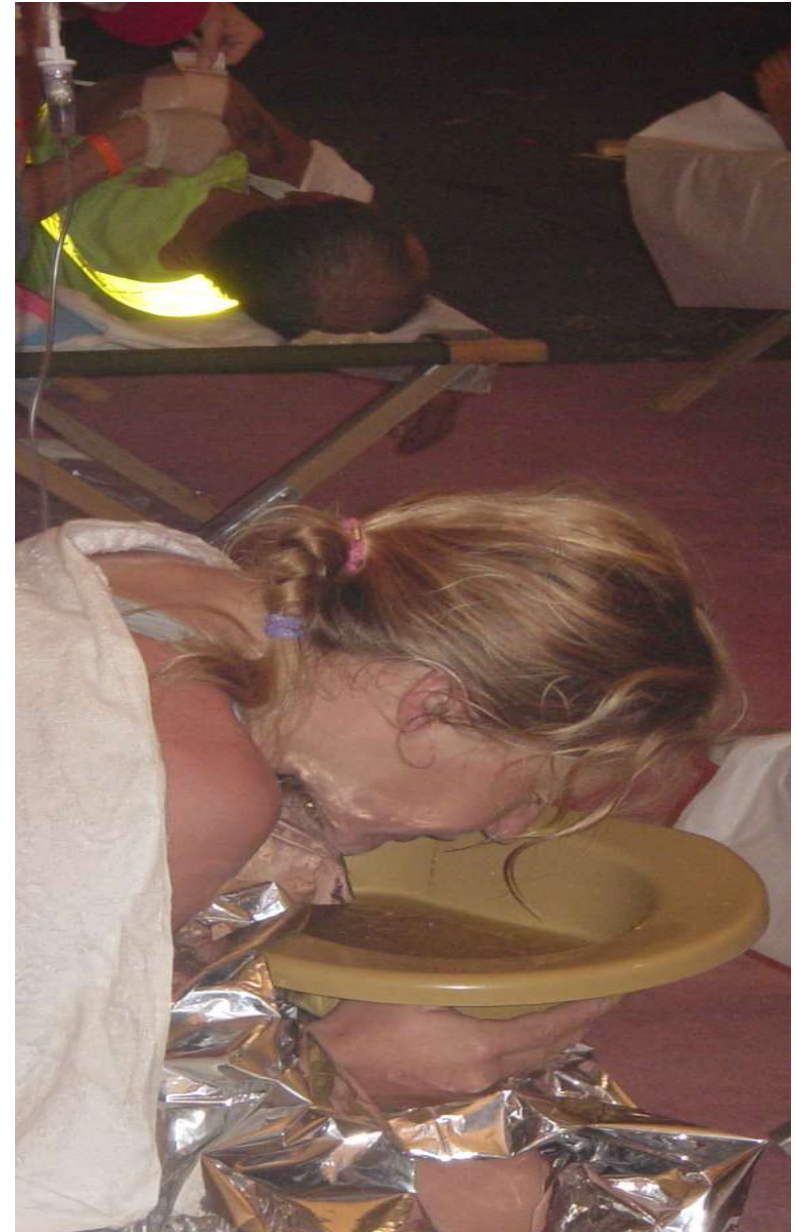
# Evaluation of the Collapsed Triathlete

- What is the level of consciousness?
- What is the temp, BP and HR?
- Is ACLS needed?
- When did the collapse occur – during the race or at the finish?



# History Questions

- Amount and type of fluid ingested during race.
- Amount of urine passed during race.
- Presence of vomiting or diarrhea.
- Amount of carbohydrate ingested before and during the race.
- Recent illness or meds.
- Race preparation.



# Examination

- Level of consciousness and mental state.
- State of hydration:
  - Weight loss or gain.
  - Thirst, lips, spit; or puffy.
- HR and BP
  - Supine and erect.
  - Pulse of 80 often represents tachycardia.
- Rectal temperature.
- Glucose and sodium concentration.

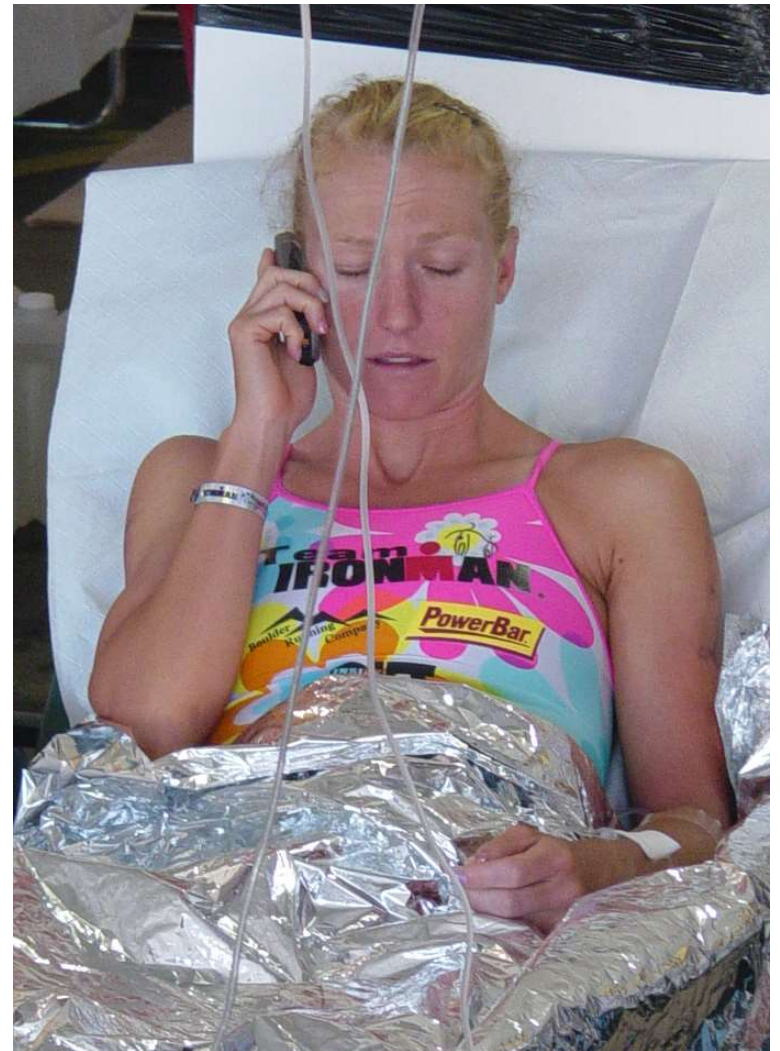




# Severity Classification for Collapse

## Benign

- Conscious and alert.
- Rectal temp  $<40^{\circ}$  C;  
SBP  $>100$ ; HR  $<100$ .
- Blood glucose 70-180  
mg/dl; Na 135-148  
mmol/L; Wt loss 0-5%.





# Benign Causes of Collapse

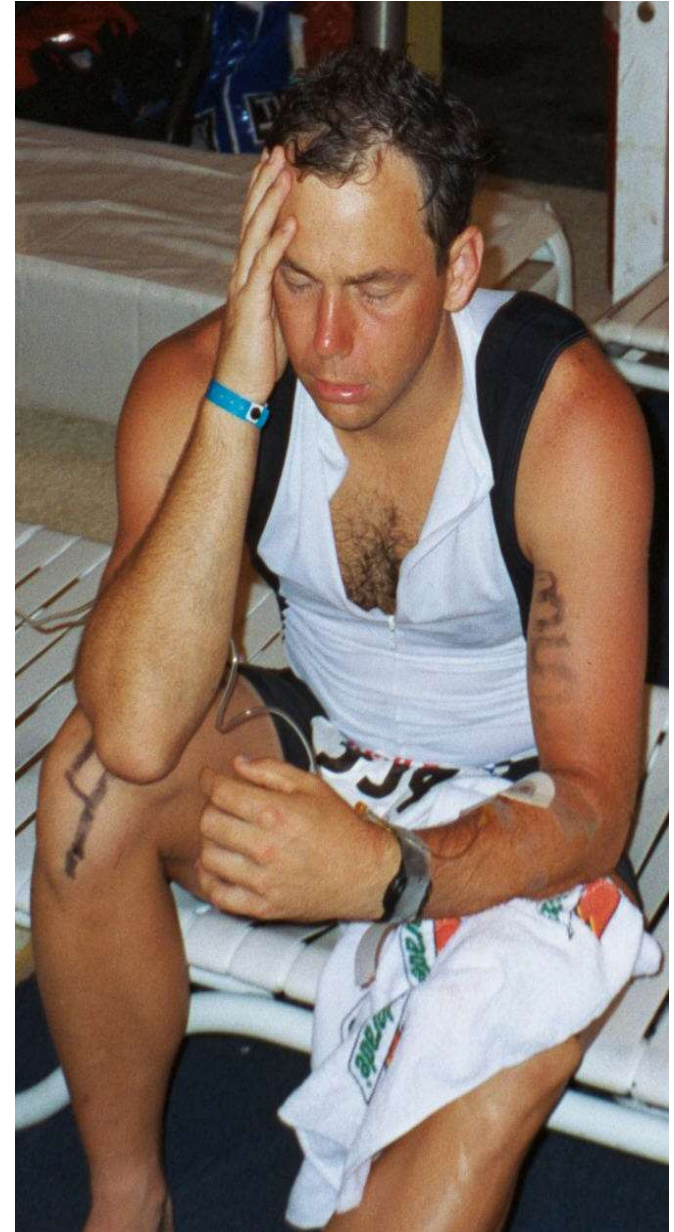
- Exhaustion and dehydration.
- Postural Hypotension.
- Muscle cramps.
- Orthopedic conditions.



# Severity Classification for Collapse

## Serious

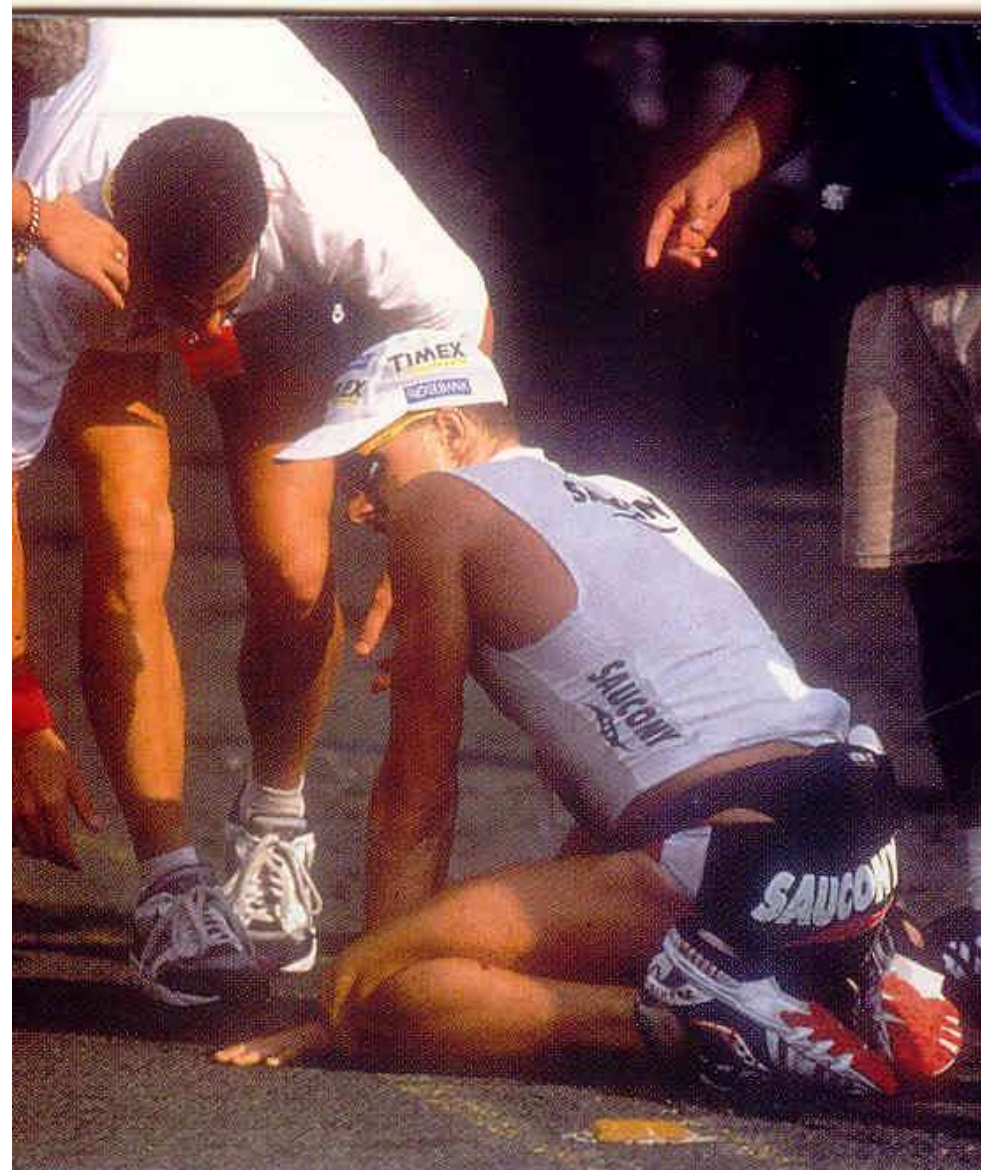
- Unconscious or altered MS (confused, disoriented, aggressive).
- Rectal temp  $>40^{\circ}$  C; SBP  $<100$ ; HR  $>100$ .
- Blood glucose  $<70$  or  $>180$  mg/dl; Na  $<130$  or  $>148$ ; Wt loss or gain  $>10\%$ .
- Wt gain suggest fluid overload.





# Serious Causes of Collapse

- Hyponatremia.
- Heatstroke.
- Hypoglycemia (usually diabetic).
- Bowel Ischemia.
- Cardiac arrest.
- Other medical conditions (seizure, subarachnoid hemorrhage).



# Collapse Often Related to Hydration Errors

**Under-drinking** ↔ **Euhydration** ↔ **Over-drinking**

- **Under-drinking**

- Dehydration
- Exhaustion
- Postural hypotension
- Muscle cramps
- Heatstroke

- **Over-drinking**

- Fluid overload with swelling.
- Hyponatremia
- Pulmonary edema
- Congestive heart failure



# Common Problems in the Ironman Medical Tent



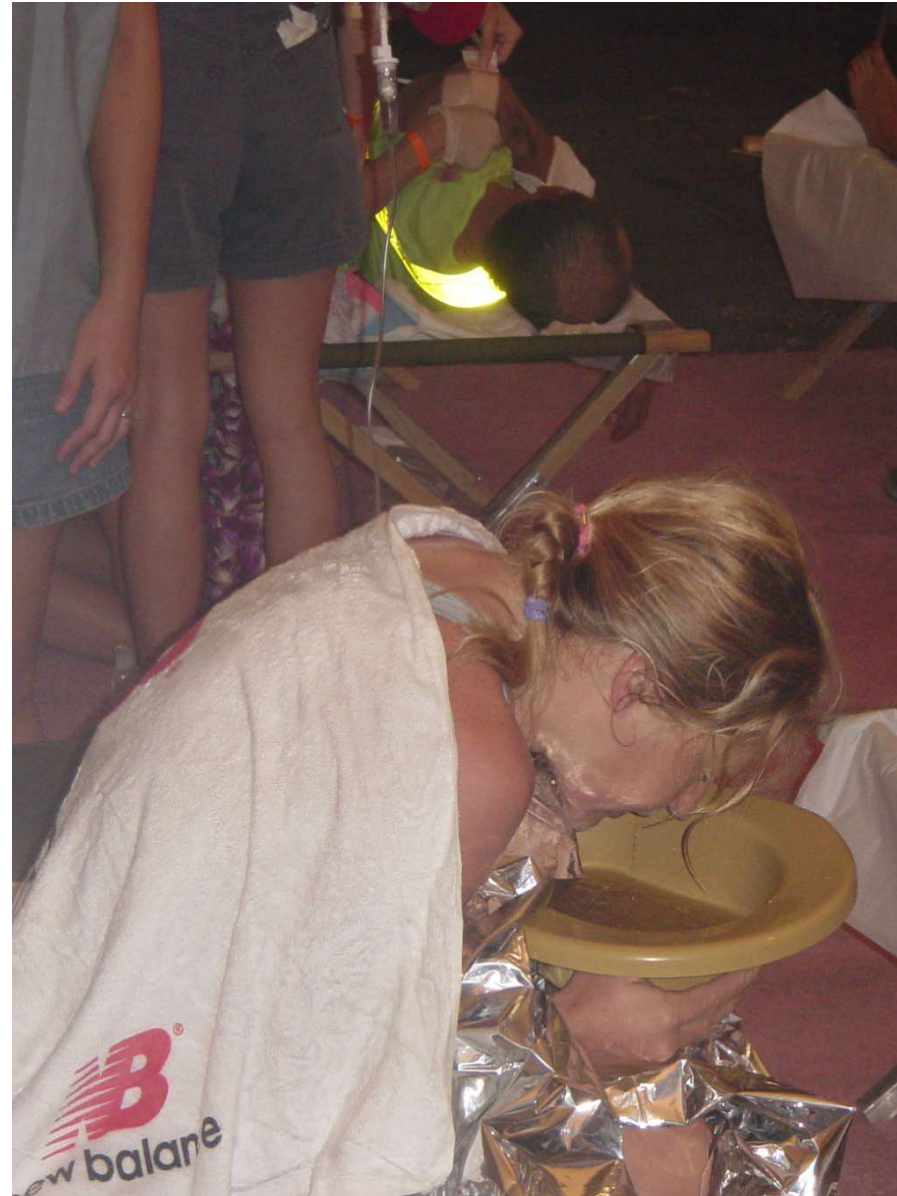
# Dehydration

- May cause collapse on basis of reduced circulating blood volume (if severe).
- Likely increases risk and severity of all causes of collapse.
- Symptoms: severe thirst, dry mouth, inability to spit.
- Exam: wt loss (best indicator); If severe ( $>5\%$ ), will see increased HR, decreased BP, poor skin turgor.
- Treatment: Oral or IV fluid as needed.



# Who Should Get IV Fluids?

- Liberal with IVF at Ironman.
- Use normal saline.
- Clear indications:
  - Significant weight loss compared with pre-race (5% or more).
  - Cannot take oral fluids.
- Risk vs. benefit
  - Avoid if fluid overloaded!
  - Helps in recovery.
  - Out of med tent faster.



# Exercise Induced GI Distress

- Nausea & vomiting, often diarrhea (may be bloody).
- Cause:
  - Intense diversion of blood away from gut to working muscle and vital organs.
  - Toxins released in gut during exercise.
- Often precipitated by eating too much.
- Bowel ischemia can occur when severe.



Chris Legh



# Treatment or Exercise Induced GI Distress

- Rest and elevate legs
- IV fluids and sips of water
- For nausea – try Zofran
- For diarrhea can try Imodium
- Often precipitated by eating too much.
  - Modify diet for prevention
  - Avoid triggers



# Postural Hypotension (Heat Exhaustion or Syncope)

- Collapse typically occurs after finish line.
- Rarely warrants hospital admission.
- Likely related to blood pooling in the skin and limbs, with loss of muscle pump action in lower legs (2<sup>nd</sup> heart) after cessation of exercise.



# Management of Postural Hypotension

- Dehydration likely increases risk.
- No evidence it will progress to heat stroke.
- Exam: temp  $< 40^{\circ}$  C; Hr  $< 100$ ; SBP  $> 100$ .
- Treatment: elevate feet and pelvis for 10-20 minutes; Give oral fluids; May need IVF.





# Muscle Cramps

- Evidence suggests 2 predisposing factors:
  - Overuse and muscle fatigue.
  - Low sodium.
- More common in hot and humid conditions.
- Risks Factors: increasing age, BMI, exercise intensity and fatigue; Along with inadequate stretching and hills.
- Treatment: keep muscle lengthened.
  - May try ice and/or massage.
  - *Magnesium* sulfate 2-4 gm IVPB or slow push.
  - Valium 2-6 mg IV.
  - Increased salt intake can help prevent.

# Heatstroke

- Look for marked change in mental function (collapse with LOC, ALOC, or mental stimulation).
- Hallmark is elevated rectal temp  $\geq 40^{\circ}$  C.
- More common in short distance races done at very high work rate.
- Rarely seen at Ironman – most likely to occur after sprint to finish.

# 1984 Women's Olympic Marathon

## Gabriella Andersen-Scheiss



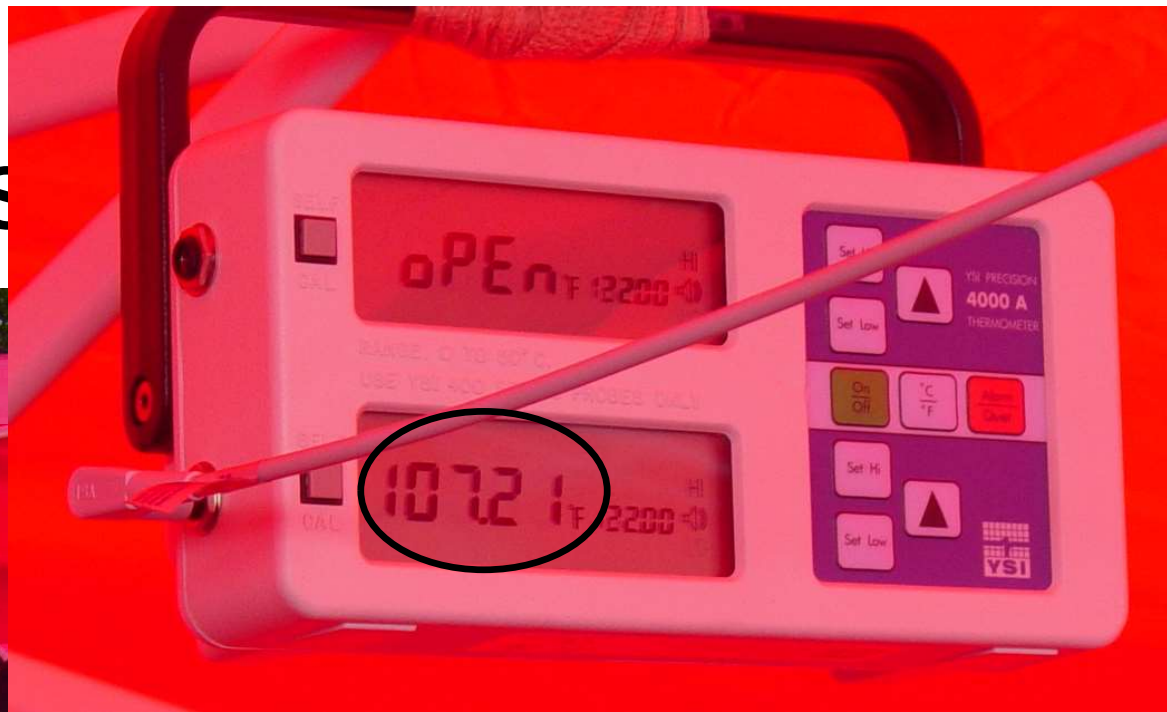


# Heatstroke (Risk Factors)

- Environmental conditions (high heat and especially humidity).
- Speed at which the athlete runs – faster more at risk.
- Individual susceptibility.
- Dehydration likely increases the risk.
- Rare event at Ironman.



# Marine Corps



# “Heat Attack”; Critical Emergency





# Heatstroke

- Collapse prior to finish.
- Exam: temp  $\geq 40^{\circ}$  C ( $104^{\circ}$  F);
  - Altered LOC.
  - Elevated HR; Decreased BP.
- Treatment: need active cooling ASAP.
  - Immerse in ice water 5-10 minutes.
  - Until temp  $\leq 38^{\circ}$  C ( $100.4^{\circ}$  F) or shivering.
- This is a “Heat Attack” –  
**Cool first, transport second!**



# Exercise-Associated Hyponatremia

- Dilutional hyponatremia caused by excess total body water relative to sodium.
  - Most often related to fluid overload and is accompanied by weight gain.
  - May also occur with dehydration and weight loss when sodium losses are partially replaced.
- Prolonged exercise can affect the kidney's ability to excrete urine.
  - Kidneys can excrete up to 800-1000 cc/hr and protects from hyponatremia.
  - Arginine Vasopressin (aka - ADH) should be maximally suppressed in face of fluid overload.

# 2 Marathon Deaths from Hyponatremia in 2002

- Cynthia Lucero (Boston Marathon)
  - April 15, 2002
- Hilary Bellamy (Marine Corp Marathon)
  - October 22, 2002
- Both fit classic pattern
  - Novice runners
  - Running for cause





# Risk Factors for Hypo

- Drinking too much before and during prolonged exercise.
- More commonly seen in females, low body wt and slower runners.
- Extreme heat or cold.
- Availability of hypotonic drinks.
- *Salty* sweaters likely at risk.
- *Sub-clinical* cystic fibrosis may be a factor (4-5% of northern European adults are carriers).



# Symptoms of Hyponatremia

- Tend to correlate with Na level, but there is tremendous variability.
- Normal serum Na 135-145.
  - Mild (131-135): usually no symptoms.
  - Moderate (Na 126-130): HA, nausea & vomiting, malaise, fatigue, bloating, “puffiness”.
  - Severe (Na <126): confusion, disorientation, “phantom running”, resp distress, coma, seizures.
  - Death can occur related to brain swelling, increased IC pressure and brainstem herniation.
- Symptoms typically resolve once large amount of dilute urine is passed.

# Phantom Running



# Hyponatremia of Exercise

- Assume hyponatremia if temp, BP, and HR normal with ALOC.
- Exam: Temp < 39° C (102° F); BP and HR stable; May look puffy (rings, wrist bands tight); Altered level of consciousness.
- Check serum Na.
- Treatment: may be fluid overloaded, use caution giving IVF; important to weigh first.
  - Can give IVF (NS) if signs of dehydration.
  - *Hypertonic* saline (3%) if Na  $\leq$  125.
  - 100cc infused quickly; repeat x 2 if needed.



# Hyponatremia at Ironman

- 45 yo male finisher; ~12 hrs; wife brought to tent confused.
  - Pre-race wt 159 lbs.;  
Post race wt 166 lbs.
  - Na 119.
- IV placed – seizure.
  - 3% saline 100cc x 2.
  - 5 gm Mag Sulfate to IV.
  - 2.5 mg Valium IV – up to 20 mg!
- Seizure stopped → *ER*





# Prevention of Hyponatremia

- Drink to match sweat loss on planned schedule.
  - Athlete must know their sweat rate.
  - Will vary with heat, humidity and exercise intensity.
  - Drinking to thirst can work for light sweater, but not for heavy sweater.
- Avoid pre-hydrating before race – cannot store excess water.
- Adequate sodium intake before and during race (sports drinks, gels, salt tabs).
- Increase distance between aid stations on course, especially late in race.

# Swimming Induced Pulmonary Edema (SIPE)

- Acute pulmonary edema and hemoptysis occurring in swimmers or divers.
  - Common in galloping racehorses (due to high pulmonary vascular pressure).
  - Also reported in cyclists, marathoners and rugby players, but much less common.
- Symptoms: hemoptysis (pink frothy sputum), cough, dyspnea, tachypnea, wheezing, CP.
  - Seawater aspiration wouldn't do all this.
  - Over-hydration thought to contribute.

# SIPE Pathophysiology

- Effects of water immersion:
  - Cold water causes vasoconstriction and increase in both preload and afterload in heart.
  - Cold water results in decreased core temp and shifts blood from peripheral to thoracic vessels.
  - Causes central blood pooling which increases heart preload and pulmonary artery pressure.
- Causes dramatic increases in pulmonary artery pressure  damages alveolar capillary membrane  pulmonary edema.



# SIPE Evaluation and Treatment

- Diagnostic evaluation:
  - Lung exam shows bilateral crackles
  - O<sub>2</sub> sat is low.
  - *CXR* shows fluffy peri-hilar opacities
- Treatment is primarily supportive
  - Remove from wet & cold.
  - Supplemental O<sub>2</sub>.
  - Diuretics can be used (common in racehorses).
  - Usually respond within 1-hour and *CXR* resolves in 24-48 hrs.



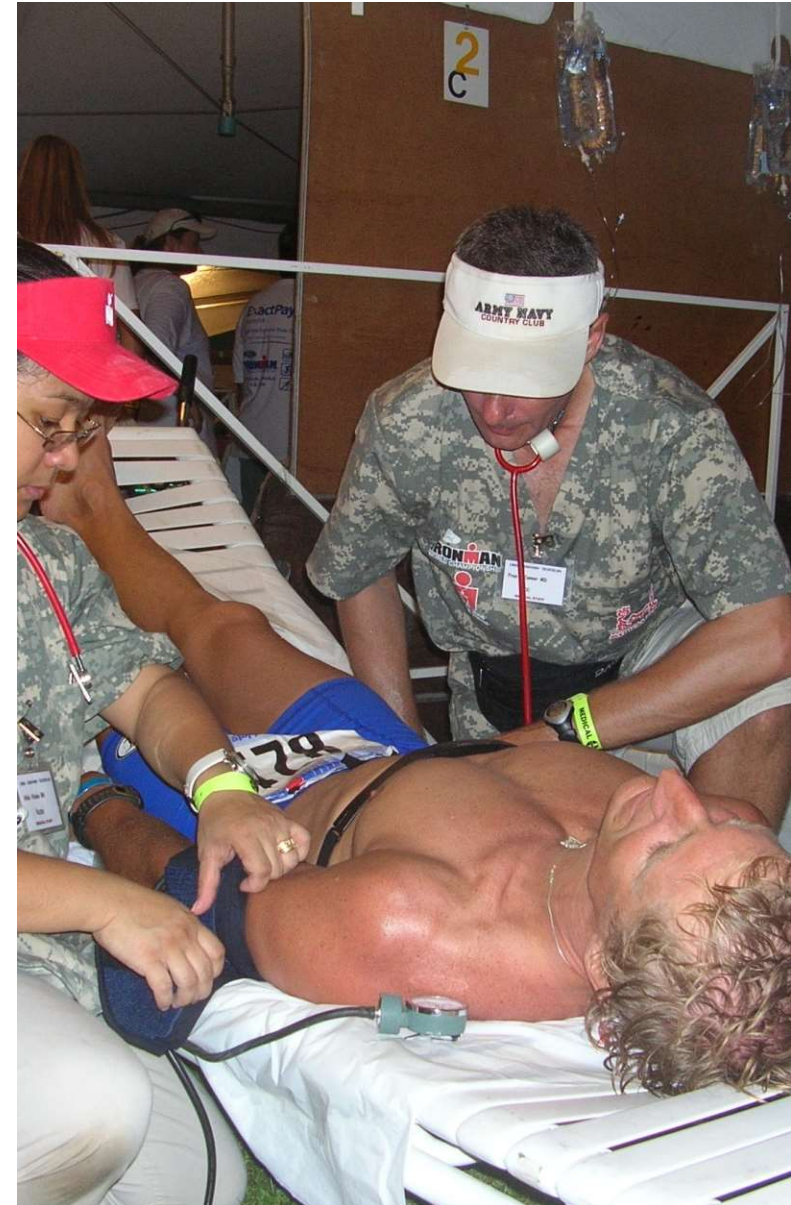
# Sudden Death During Triathlon

- Overall sudden death rate;
  - Triathletes ~1.5 per 100,000 participants.
  - Marathon ~ .8 per 100,000 participants (BMJ 2007;335).
- In triathlon, ~90% of deaths are in the swim.
  - Unforgiving environment compared to bike or run.
  - Swim provokes most anxiety which can promote arrhythmias.



# Kona Ironman Medical Tent

- Athletes who are sick or collapse taken to triage area.
  - Collapse after finish line usually less serious than collapse before finish line.
  - Keep athletes walking after finish or elevate legs.
- Triage doc determines what athletes should be admitted into the medical tent or kept in observation area.
- Data sheet completed on all athletes seen in triage area.





# Medical Tent Record

- Should complete on all athletes seen.
- Record vital signs and *weight* on all athletes (compare with pre-race).





# Med Tent Eval & Tx - Key Points

- Vital signs – wt loss or gain?
  - Normal resting pulse often in 50's
  - Need rectal temp if heat stroke suspected
- History and exam
  - Mental status
  - Swelling vs. signs of dehydration
  - Heart/lung/abdomen
- Elevate legs and oral fluids
- Establish IV line if high risk
  - Altered level of consciousness
  - Significant wt loss (5% or more)
  - Nausea and/or vomiting



# Available Medications

- **Normal Saline** IV for symptomatic dehydration after trying oral fluids
- **Zofran** 8 mg ODT or 4mg IV/IM for persistent N&V
- **Mag Sulfate** 3-5 gms added to 500 ml IV bag or slow IV push (hypotension) for severe cramping.
- **Midazolam (Versed)** 1 mg IV Q2-3 min(2.5 max) for seizure (can give IV or nasal)
- **Diphenhydramine (Benadryl)** 25-50 mg IM or IV for severe allergic reactions
- **D50** 1 amp (50 ml vial) IV for severe hypoglycemia
- **ASA** 81 mg; **Albuterol Neb**; **Lido Gel**

# Miscellaneous Problems

- Subungual hematomas
  - Drain with cautery if painful
- Blisters
  - Consider draining if large (>1cm) or in bad spot
  - Apply Duoderm (x 3 days)
- Corneal Abrasions
  - Stain with Fluorescein
  - Apply antibiotic and homatropine drops
- Jelly fish stings
  - Apply white vinegar
- Sunburn
  - Aloe Vera + 1% Hytone cream
  - ASA or NSAID for pain





# Watch for Vasovagal Syncope





# Conclusion

- The vast majority of problems presenting to the Ironman Medical tent are easily managed by the medical team.
- A good history and exam is essential for evaluation.
- Collapse is common:
  - Usually benign when collapse is after finishing, normal vital signs, and remain conscious.
  - More likely serious when collapse before finish, have unstable vital signs, or an ALOC.
  - Weight change is a helpful guide to treatment.
- Good communication and collaboration is essential for optimum care.

# Thank You!

