CE21268: Emerging Practice Areas and Skills in Athletic Training

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HUGHSTON SPORTS MEDICINE eamc east alabama medical center

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  - DJO
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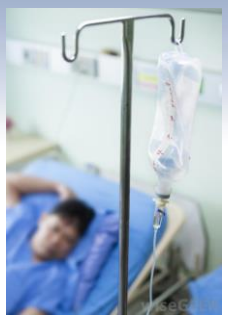
Topic #1 Heat Illness and Fluid Replacement



Program Goals

- Identify the various types of acute dehydration and exertional heat illness
- Review the etiology of acute dehydration and exertional heat illness
- Review the appropriate evaluation methods for acute dehydration and exertional heat illness

Program Goals

- Identify the various types of commonly available treatments for acute dehydration and exertional heat illness
- Identify the appropriate indications for the application of commonly available treatments for acute dehydration and exertional heat illness
- Identify the appropriate contraindications for the application of commonly available treatments for acute dehydration and exertional heat illness

Program Goals

- Identify the appropriate precautions and other considerations for the application of commonly available treatments for acute dehydration and exertional heat illness
- Identify and demonstrate the appropriate selection and application methods for the application of commonly available treatments for acute dehydration and exertional heat illness

Hyperthermia

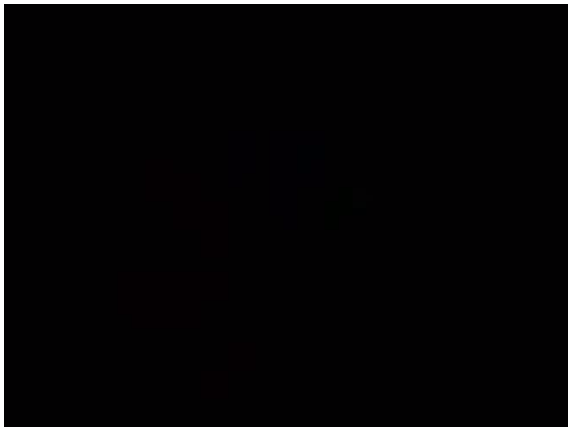
- Major concern in sports. Especially in the southern region.
- Need to be aware of temperature and humidity.

Hyperthermia

- Heat Cramps
- Heat Exhaustion
- Heat Stroke

Heat Cramps

- Body will produce painful muscle cramps for multiple reasons.
  - Body is dehydrated and wants to stop activity = >5% loss in body mass
  - Internal body temp is elevated to abnormal level
  - Sickle Cell crisis
- Need to know status of sickle cell trait / disease. Can be misdiagnosed as cramps (Casa JAT 2013)
- NCAA now mandates testing for athletes in Division I and II or waiver release.



NCAA Recommendations

- Set their own pace.
- Engage in a slow and gradual preseason conditioning regimen to be prepared for sports-specific performance testing and the rigors of competitive intercollegiate athletics.
- Build up their intensity slowly while training.

NCAA Recommendations

- Use adequate rest and recovery between repetitions, especially during “gassers” and intense station or “mat” drills.
- Not urged to perform all-out exertion of any kind beyond two to three minutes without a breather.
- Be excused from performance tests such as serial sprints or timed mile runs, especially if these are not normal sport activities.

NCAA Recommendations

- Stop activity immediately upon struggling or experiencing symptoms such as muscle pain, abnormal weakness, undue fatigue, or breathlessness.
- Stay well hydrated at all times, especially in hot and humid conditions.
- Maintain proper asthma management.

NCAA Recommendations

- Refrain from extreme exercise during acute illness, if feeling ill, or while experiencing a fever.
- Access supplemental oxygen at altitude as needed.
- Seek prompt medical care when experiencing unusual distress.

S&S Heat Cramps

- Dehydration
- Thirst
- Sweating
- Transient Muscle Cramps
- Fatigue

Treatment

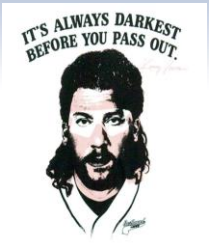
- Stretching – try to keep weight bearing
- Fluid Replacement
- Core body temp if available
- “Pickle Juice”

Question

- Who has more trouble in the heat?
  - A defensive back with 4% body fat.
  - Offensive lineman who weighs 350 pounds

Heat Exhaustion

- Defined as the inability to continue activity due to any combination heavy sweating, dehydration, sodium loss, and energy depletion.



S&S Heat Exhaustion

- Normal or elevated body temp
- Dehydration
- Dizziness
- Headache
- Nausea
- Vomiting
- Cool, clammy skin
- Decreased urine output, etc…

Treatment

- Remove from heat
- Cool body accordingly
- Treat any other medical symptoms and monitor

Heat Stroke

- Defined as having an elevated core body temp (Greater than 104 F) with associated signs of organ system failure due to hyperthermia.
- Need Rectal Temp
  - (Casa 2013 JAT)

Rectal Temp

- Thermistor's
- Can be left in place

Rectal Temp

1. Drape the patient appropriately for privacy
2. Position the patient on their side with their top knee and hip flexed forward
3. Make sure the probe is cleaned with isopropyl alcohol
4. Lubricate the probe
5. Make sure the probe is plugged into the thermometer

Rectal Temp

6. Turn the thermometer on
7. Insert the probe 10 centimeters past the anal sphincter
8. If you meet resistance while inserting, stop and remove the probe, then try again
9. Leave the probe in for the duration of treatment.

S&S Heat Stroke

- Hot and Dry Skin
- Tachycardia (100 to 120 bpm)
- Central Nervous System Changes
- Hyperventilation

Treatment

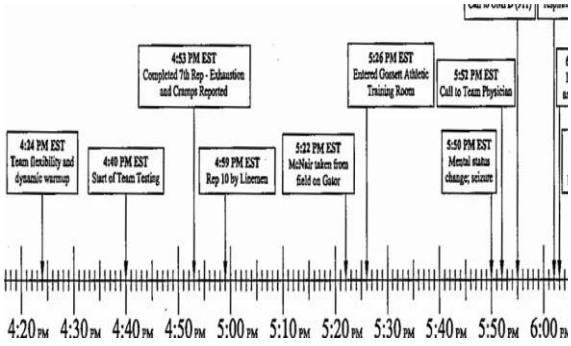
- Decrease body temp and seek advanced medical care
- Be careful w/ Immersion

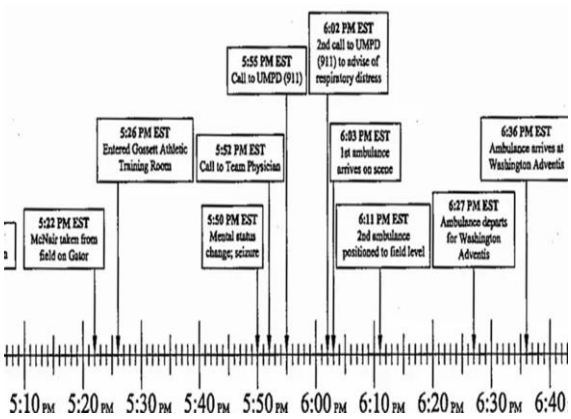
Monitoring Methods

- Wet Bulb Globe Therm.
- The Wet Bulb Globe Temperature reading is a composite temperature used to estimate the effect of air temperature, humidity, and solar radiation on the human body.

Recent Situations

- Maryland – May 29th, 2018





Key Gaps in Timeline

- The time from onset of cramps to being removed from field was 34m 12s
- The time treated in athletic training room prior to change in stature was 23m 55s
- The time from 911 call to ambulance arriving at the parking lot in front of Gossett Team House was 8m 33s
- The time from the 911 call to departing the stadium was 37m 3s
- The onset of symptoms to the call to 911 was 1h 7m
- The time from onset of symptoms following the seventh repetition to departure in the ambulance en route to Washington Adventist was 1h 39m 3s.

Question about Cold Immersion

- The Head Football Athletic Trainer [Wes Robinson] was questioned about why the decision to not utilize the cold whirlpool to cool Jordan McNair following the change in status and seizure activity. He answered due to the concern of size of the student-athlete and the smaller stature of the athletic trainers providing care, there was fear of drowning. Cooling was attempted with cold towels and ice packs to the groin and axilla.

TACO

- Tarp Assisted Cooling w/ Oscillation

Conclusions

- The injury evaluation did not include any assessment of vital signs. Specifically, core temperature was not established which ultimately is a critical part in identifying a rapid decline in the athlete's physical state

Conclusions

- Treatment provided did not appropriately address the escalating symptoms of heat-related illness. The prehospital care of exertional heat illness should include rapid recognition and treatment of signs and symptoms associated with this condition. No vital signs were noted including core temperature.

Conclusions

- No apparatus was used for prompt cooling of the patient May 29, 2018. This is discussed in the literature as best practice and needs to be part of the University of Maryland Sports Medicine Services Staff Manual. The current procedures does not include core temperature assessment but does include aggressive cooling in the event of an identified exertional heat illness.

Conclusions

- Failure to provide directions to EMS to the scene and designate an individual to flag down EMS and direct to scene. There was confusion as EMS arrived in the Gosset parking lot while the target point was the field level driveway as referenced in the EAP in the 2017-18 Med Manual E-Book and Staff Administration E-Book.

Conclusions

- Once the patient's condition deteriorated, and respiratory aids were needed, the trauma bag had to be retrieved from the practice area as equipment (manual suction or oxygen) was not available in the Gosset Athletic Training Room.

Introduction to IV Therapy

- Indications for IV therapy
  - To provide water, electrolytes, and nutrients to meet daily requirements
  - To replace water and correct electrolyte deficits
  - To administer medications and blood products

What do IV solutions consist of?

- IV solutions contain electrolytes or dextrose mixed in various proportions with water.
- Electrolyte-free water *cannot* be administered by IV as it would too rapidly enter the red blood cells and cause them to rupture.

Types of IV Solutions

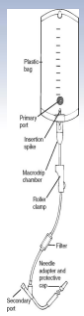
- Colloids – large molecules
- Crystalloids – small molecules
  - Isotonic – similar osmolarity as serum
    - **HYDRATION!** – fluid volume expansion
    - Maintain electrolytes.
  - Hypotonic – less solutes in solution than in serum
  - Hypertonic – more solutes in solution than in serum
- Blood products

Most commonly used IV fluids

- Normal saline (NS)
  - Most commonly used IVF as it meets most hydration needs.
- Lactated Ringer's (LR)
  - Mixture of NaCl, KCl, CaCl, & Na lactate.
  - Commonly administered to those with burns / severe trauma.
- 5% Dextrose in water (D5W)* -may be added to other solutions
  - Is BOTH isotonic and hypotonic solution!
  - Provides 170 cal/L

Administration of IV Fluids

- Use an IV infusion set
  - A drip chamber is connected to the IV bottle or bag
  - flow rate is adjusted to drops per minute (gtt/min) with roller clamp
  - Injection ports - located on the IV tubing & on most IV solution bags
    - allow for injection of medications directly into IV bag or IV line
    - injection ports also allow for attachment of secondary IV lines for IVPB medications

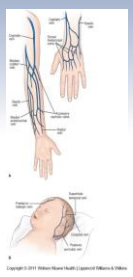


Gaining IV Access

The main factors to consider:

- Location
  - Anatomy
- Size
  - Of patient and/or vessel
  - Of catheter
- Situation

IV sites



- Superficial veins of forearm, hand, upper arm, and scalp of children.
- Arm veins are preferred
  - relatively safe and easy to enter
- IVs are rarely placed in veins of lower extremities as there is greater risk of complications in these sites.

Determining IV Location

- Choose a site that does not interfere with mobility – does not cross a joint.
- Start distally and move proximally.
  - This allows subsequent IV placement to move following blood flow.
- Anatomy of your patient.
  - Trauma/restrictions
  - Choose straight vessel that is longer than the catheter
  - Avoid areas of biforcation.

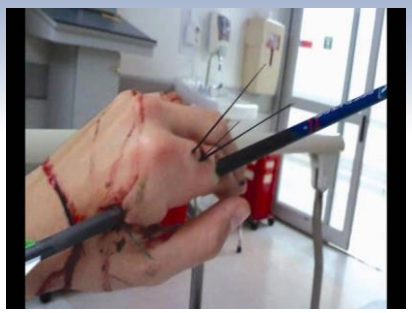
IV Catheter Size

- The number on the catheter (the gauge) is INVERSELY related to the diameter of the catheter.
  - I.E. - A 20ga IV is *BIGGER* than a 22ga but *smaller* than an 18ga.

Don't believe the rumors:

- Size DOES matter.
- You have to consider:
  - Size of vessel
  - The function of the IV for the particular situation
    - Pre-surgery
    - Rapid rehydration
    - Trauma
    - Potential tests and procedures
    - Blood transfusion

Selecting IV Your Catheter



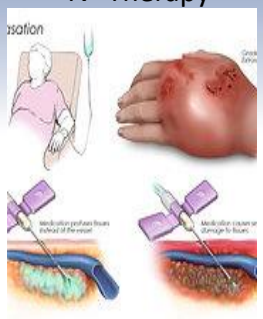
IV Size

- The standard length of a peripheral IV catheter is 1.5 inches long.
- There are other length IV's:
  - Pediatrics – smaller
  - Ultrasound guided IV's - longer

Length of Use

- Peripheral IV's don't last forever!
  - The latest EBP recommends removing IV catheters at least every **96 hours** (4 days).
  - If an IV site has become compromised the IV should be removed and a new one should reestablished immediately.

Common Complications of Peripheral IV Therapy



Phlebitis : inflammation of a vein

- Signs & symptoms of phlebitis
  - redness, swelling, pain, and edema at the insertion site and/or along the vein
  - Treatment - removal of catheter & application of ***warm soaks***

Infiltration : venipuncture device is dislodged from the vein

- S & S:
  - local edema
  - skin blanching
  - skin coolness
  - leakage at the puncture site
  - Pain & feelings of Tightness
  - blanching at the site
  - ***absent backflow of blood***
- Treatment:
  - Discontinue the IV and monitor the site.

How to actually start an IV

1. Select vein by palpating with pad of finger.
2. Choose an appropriate sized IV catheter.
3. Prepare all supplies
   a) Open all packages.
   b) Prime extension loop if using one.
   c) Make sure you have a dressing or securement device.
4. Apply tourniquet ~4 inches above insertion site.

How to actually start an IV

5. Cleanse the area using alcohol or other cleansing agent.
6. Anchor vein by gently pulling down on skin with thumb of non-dominant hand.
7. With the bevel facing UP and at an angle of approx. 30 degrees, insert needle into vessel.

How to actually start an IV

8. When you see "flash" in the chamber, insert needle ¼" further, then advance just the catheter.
   - ❖ NEVER pull catheter back over the needle! This may cause the needle to puncture or tear the catheter.
   - ❖ NEVER force the catheter to advance if you meet resistance!
9. After fully inserting catheter into vessel, remove needle only after you have engaged your safety device.

How to actually start an IV

10. Remove tourniquet!!!
11. Attach primed extension loop, INT, or primed fluid tubing to catheter.
12. Appropriately dress/secure your IV catheter.
13. Dispose of needle in an appropriate Sharps Container.
14. Your IV is now ready to infuse fluids at prescribed rate, administer medications, etc.

Here's a visual:

- https://www.youtube.com/watch?v=aq8OwFaIQ4I

Clinical Question

- **Can immediate utilization of intravenous fluid administration (I) improve patient recovery and outcomes (O) for patients or athletes with exertional heat exhaustion (P)?**
- P: Patients or athletes with exertional heat exhaustion.
- I: Immediate utilization of intravenous fluid administration.
- O: Improve patient recovery and outcomes.

Literature Review

- National Athletic Trainers' Position Statement: Exertional Heat Illnesses. (2015)
- Remove clothing and equipment, move athlete to a cool and shaded area, and cool with fans and ice towels
- Monitor vital signs and place in recovery position.
- If recovery is not rapid (within 30 minutes of initiation of treatment) and uneventful, fluid replacement should begin and the patient's care transferred to a physician

Literature Review

- Intravenous fluid use in athletes. (2012).
- WADA prohibits routine practice of administering IV fluids (>50 mL per 6 hours) to healthy individuals.
- IV treatment of severe dehydration (>7% body weight loss), exertional heat illness, nausea, emesis, or diarrhea, and in those who cannot ingest oral fluids for other reasons, is clinically indicated.

Literature Review

- National Athletic Trainers' Position Statement: Fluid replacement for the physically active. (2017).
- Only if oral fluids are not tolerated or fluid losses are ongoing (from vomiting or diarrhea) should intravenous (IV) fluids be administered
- Outcomes after rapid IV rehydration suggest no lasting benefits exceeding those of oral rehydration,
- If EAH, Exercise-associated hyponatremia, is suspected, a serum or blood sodium level should be measured before oral or IV (hypotonic or isotonic) fluid is administered.

Clinical Question

- **Can immediate utilization of intravenous fluid administration (I) improve patient recovery and outcomes (O) for patients or athletes with heat stroke (P)?**
- P: Patients or athletes with heat stroke.
- I: Immediate utilization of intravenous fluid administration.
- O: Improve patient recovery and outcomes.

Literature Review

- National Athletic Trainers' Association Position Statement: Exertional heat illnesses. (2015).
- Fully body cold water immersion is best practice.
- Remove from CWI when core temp reaches 102 degrees F.
- Treat first, transport second.
- An intravenous fluid line can be placed for hydration and support of cardiovascular function.

Literature Review

- Intravenous fluid use in athletes. (2012).
- Current studies do not support the use of IV fluids for rehydration when an athlete can tolerate oral fluids.
- IV treatment of severe dehydration (>7% body weight loss), exertional heat illness, nausea, emesis, or diarrhea, and in those who cannot ingest oral fluids for other reasons, is clinically indicated.

Literature Review

- National Athletic Trainers' Position Statement: Fluid replacement for the physically active. (2017).
- Some recent evidence suggests that recovery from hypohydration (approximately 4% body mass loss) is most efficient with the use of IV and oral fluids together.
- When oral fluids are not tolerated (because of vomiting, extreme nausea, or excessive diarrhea), IV fluids can be used as a primary intervention.
- Outcomes after rapid IV rehydration suggest no lasting benefits exceeding those of oral rehydration

Clinical Question

- **Can a current research-based approach to diagnosis, treatment, and prevention of heat illness (I) reduce the likelihood of physically-active patients or athletes (P) succumbing to heat illness (O)?**
- P: Physically-active patients or athletes.
- I: Development and utilization of properly-formatted emergency action plans.
- O: Increase response time for medical providers and access to emergency care and equipment.

Literature Review

- The inter-association task force for preventing sudden death in secondary school athletic programs: best-practice recommendations. (2013)
- Most of the deaths in secondary school sports can be avoided by providing appropriate prevention, recognition, and treatment strategies.
- EAP should be site specific and reviewed each sport season by all coaches, assistant coaches, and athletics and medical personnel in coordination with local EMS.

Literature Review

- Inter-association consensus statement on best practices for sports medicine management for secondary schools and colleges. (2014).
- All schools with athletic programs have emergency action plans that are written, posted, and practiced by all who have responsibility for the acute management of athletes' injuries and illnesses
- Policies and procedures should include specific return-to-play protocols for concussions and other injury and illness situations including heat illness.

Heat Illness Answers

- 1) D. Heat Stroke
- 2) B. Rectal thermometer
- 3) B. False
- 4) A. Arm
- 5) D. All of the above
- 6) B. False
- 7) D. Greater than 5%
- 8) D. 20
- 9) C. Antiseptic wipe
- 10) D. 96 hours

Topic #2 Fracture Care

Program Goals

- Identify the various types of common orthopaedic fractures
- Review the etiology of common orthopaedic fractures
- Review the appropriate evaluation methods for potential orthopaedic fractures

Program Goal

- Identify the various types of casting and splinting methods available for acute orthopaedic fractures
- Identify the appropriate indications for the application of various types of casts and splints.

Program Goals

- Identify the appropriate contraindications for the application of various types of orthopaedic casts and splints.
- Identify the appropriate precautions and other considerations for the application of various types of orthopaedic casts and splints.
- Identify and demonstrate the appropriate selection and application methods for various types of orthopaedic casts and splints

Fracture Evaluation

- Tuning Fork
- Vibrations can cause pain near site of fracture

Fracture Evaluation

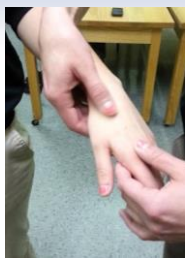
- Tap/Percussion Test
- Commonly used on fingers/toes
- Pain is + test
- Can implicate fracture

Fracture Evaluation

- Bump Test
- Sharp pain can indicate lower leg fracture

Fracture Evaluation

- Long Bone Compression
- Commonly used for metacarpals and metatarsals
- Pain can indicate fracture



Fracture Evaluation

- Squeeze Test
- Used to asses parallel bones (radius & ulna, tib/fib)
- Pain at site of fracture regardless of where squeeze occurs

Fracture Evaluation

- X-Ray
- L: Possible stress Fx of midshaft of 3rd MT
- R: Humeral shaft Fx

Fracture Evaluation

- Bone Scan: Darkened areas indicate stress Fx

Fracture Evaluation

- CT Scan
- Scaphoid Fx

Fracture Evaluation

- Poor Man's X-Ray
- US over a suspected fx will cause pain

Fractures: Open vs. Closed

Open

- A open fracture breaks the skin and comes in contact with the outside environment
- This may occur through a large wound in the soft tissue and skin or through a tiny puncture wound
- Another name is "compound fracture"

Closed

- A closed fracture implies a fracture remains encased within the skin and musculature that surround it
- No wound or mucosal membrane overlies the fracture
- The fracture does not come in contact with the outside environment
- Another name is "simple fracture"

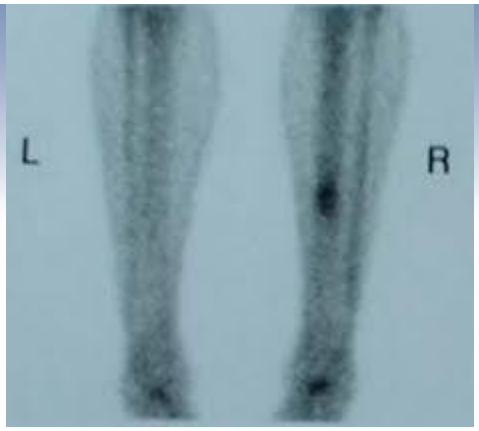
Fracture Type: Incomplete

- An incomplete fracture implies that a bone has not completely lost continuity; some portion of the bone remains intact
- There are several types of incomplete fractures
  - Stress
  - Greenstick
  - Depression

Stress Fracture

- A stress fracture is a small crack in a bone, or severe bruising within a bone.
- Common in runners and athletes who participate in running sports, such as soccer and basketball
- Etiology: Overuse and repetitive activity

Stress



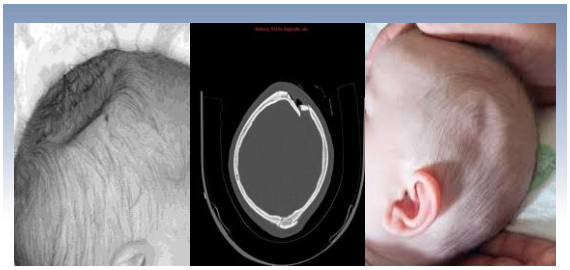
Greenstick Fracture

- Common in younger populations, the bone bends and only fractures on one side
- Resembles the break that results when a green branch of a tree is bent and breaks incompletely
- Usually the side opposite the bending force fractures completely, while the side under the force remains intact
- Etiology: Sports, Motor Vehicle Accidents (MVAs), Falls

Greenstick Fracture

Depressions Fracture

- Multiple fissure fracture lines intersect
  - The entire area will depress from the direction of force
- Most common in cranial bones, maxilla or frontal bones
- Etiology: Blunt Force Trauma



Depression Fracture

Fracture Type: Complete

- Complete fractures are indicated by the complete loss of bony continuity, allowing overriding and deformation
- There are several types of incomplete fractures:
  - Transverse
  - Oblique
  - Spiral
  - Comminuted
  - Impaction
  - Compression

Transverse fracture

- Transverse fracture implies a fracture line that is transverse to the long axis of the bone
- Etiology: Bending Forces

Transverse fracture

Oblique fracture

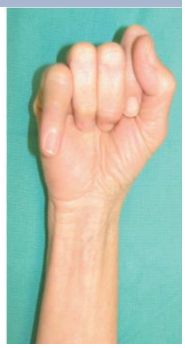
- Fracture line is oblique to the long axis of the bone
- The two cortices of each fragment are in the same plane without spiraling
- The cortical edges are flat, rather than sharp
- Etiology: Bending, with superimposed axial compression

Oblique fracture

Spiral Fracture

- Fracture line that spirals along the long axis of the bone
- Spiral fractures tend to have extremely sharp points and edges, which frequently accompany soft tissue trauma or an open fracture.
- Etiology: Torsional twisting or rotational forces.
  - Reduction of spiral fractures is difficult without constant traction or internal fixation, since these fractures tend to override and rotate into deformity

Spiral Fracture



Comminuted

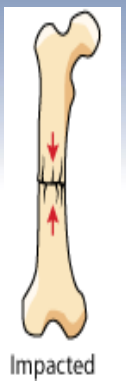
- Bone is splintered into more than two fragments,
- Etiology: high impact trauma (ex. Car/ATV accidents)
- Comminuted fracture implies at least three fracture fragments
  - The individual fracture lines that form the comminuted fracture may be transverse, oblique, or spiral.
- Etiology: High-energy trauma, MVAs
  - Comminuted fractures are difficult to reduce and fix because they have no inherent stability.
  - Constant external traction and alignment or internal fixation is required

Comminuted

Impaction Fracture

- An impacted fracture implies a fracture in which a bony fragment, generally cortical, is forced or impacted into cancellous bone.
- Typically this occurs at the ends of long bones.
- Etiology: Falls, trauma, and a direct blow to a bone
  - Reduction of such fractures requires traction to disengage the fragments and fixation to hold the fragments apart
- If malalignment is untreated, bone shortening will occur

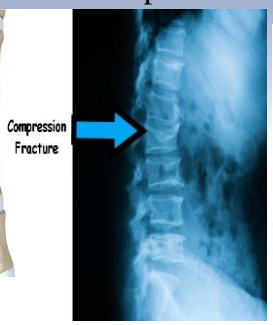
Impact Fracture

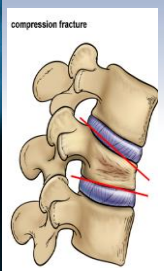


Compression

- Bone collapses, particularly in short bones such as the vertebrae
- Typically this occurs in vertebral bodies following trauma to the spine.
- Etiology: Head down tackling, whiplash in MVAs
  - Rarely reduced, since the bone within the fracture area has been destroyed by the crushing

Compression





Fracture Type by Location

- Fractures may be classified by their anatomical location in relation to a specific bone
- Identifying a fracture by location does not indicate whether the fracture is open or closed, nor does it indicate the type of fracture: transverse, oblique, spiral, etc.
- The systems of classifying by type and classifying by location are compatible and should be used together

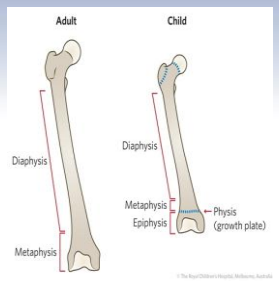
Fracture Type by Location

- Diaphyseal Fracture
- Metaphyseal Fracture
- Epiphyseal Fracture
- Salter-Harris
- Avulsion Fracture
- LeFort Fracture
- Orbital Blowout Fracture
- Colles' Fracture
- Smith's Fracture
- Jones Fracture
- Jefferson Fracture
- Hangman's Fracture

Diaphyseal Fracture

- Any fracture within the anatomical diaphysis of a long bone is referred to as a diaphyseal fracture.
- Etiology: Trauma or bending forces

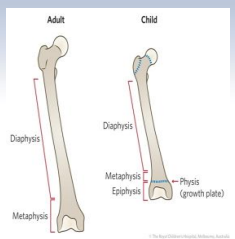
Diaphyseal Fracture



Metaphyseal Fracture

- Any fracture within the anatomical metaphysis of a bone is referred to as a metaphyseal fracture
- Most metaphyseal fractures are through cancellous bone, they generally heal rapidly
- Etiology: Tension and shearing forces and repetitive forces

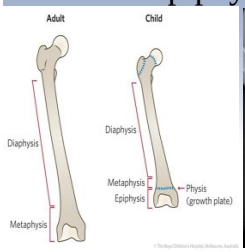
Metaphyseal Fracture

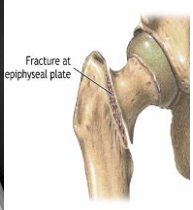


Epiphyseal Fracture

- Any fracture within the anatomical epiphysis of a bone is referred to as an epiphyseal fracture
- Etiology: Blunt force trauma, MVAs, repetitive stress on the bone

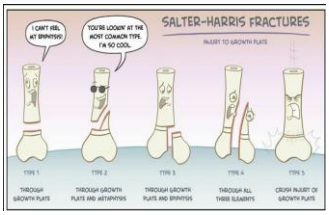
Epiphyseal Fracture





Salter Harris

- A Salter–Harris fracture or growth plate fracture is a fracture that involves the epiphyseal plate or growth plate of a bone
  - It is thus a form of child bone fracture.
- Fractures of the epiphyseal plate are classified further to accurately describe their shape and severity of the fracture.
- The method of Salter- Harris is the standard classification

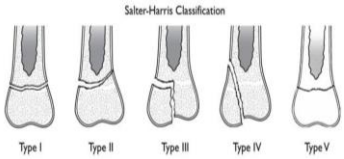


Type I

- Type I-Epiphyseal separation: there is displacement of the epiphysis from the metaphysis at the growth plate.

Type II

- Type II-A small corner of metaphyseal bone fractures and displaces, with the epiphysis displaced from the metaphysis at the growth plate.



Type III

- Type III-Fracture is through the epiphysis and part of the growth plate, but the metaphysis is unaffected.

Type IV

- Type IV-Fracture is through the epiphysis, growth plate, and metaphysis. Several fracture lines may be seen.

Type V

- Type V-Impaction of the epiphyseal plate occurs, with the metaphysis driven into the epiphysis.

Avulsion Fracture

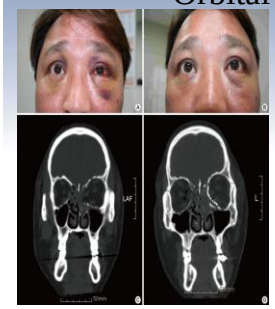
- An avulsion fracture is an injury to the bone in a location where a tendon or ligament attaches to the bone
  - When an avulsion fracture occurs, the tendon or ligament pulls off a piece of the bone
- Etiology: Muscular contraction, sudden forceful pull on a tendon while the bone is moving in the opposite direction
  - Reduction and fixation is difficult and requires constant traction or internal fixation

Avulsion Fracture

Orbital Blowout

- An orbital blowout fracture is a traumatic deformity of the orbital floor or medial wall
- Etiology: Trauma from a blunt object larger than the orbital aperture, or eye socket

Orbital Blowout



Colles'

- A complete fracture of the radius bone of the forearm close to the wrist resulting in an upward (posterior) displacement of the radius and obvious deformity
- Etiology: FOOSH
  - Falling onto wrists in extension

Colles'

Smith's

- A fracture of the distal radius area with a fracture fragment displaced or angulated in the volar direction
  - AKA reverse Colles' fracture or Goyrand-Smith's. It
- Etiology: Direct blow to the dorsal forearm or falling onto flexed wrists
  - Falling onto wrists in flexion

Smith's

Jones

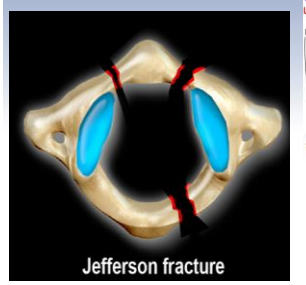
- A fracture of the fifth metatarsal of the foot
  - Results in pain near the midportion of the foot on the outside.
  - May also be bruising and difficulty walking
- Etiology: Overuse or stress of the mid foot

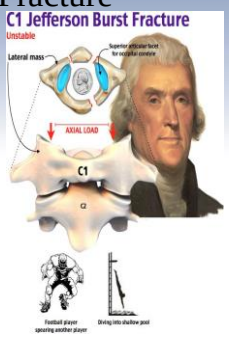
Jones

Jefferson Fracture

- A fracture of the vertebra C1 (Atlas)
  - Extreme hyperextension of cervical spine
- Etiology: Diving accident (striking the bottom of the pool), MVAs (impact against the roof of a vehicle), axial loading

Jefferson Fracture





Hangman's Fracture

- A fracture of the vertebra C2 (Axis)
  - In most cases lethal
- Etiology: Self Inflicted, sports, MVAs

Hangman's Fracture

Casting – Key Points

- Proper Selection for condition you are treating
  - Best case 24 to 48 hours after injury
- Proper positioning – Position of Function
- Application of barrier – stockinette
- Padding – 2 to 3 inch upper, 4 to 6 inch lower
- Prepare casting materials – tepid water
- Follow up – 1 to 2 weeks

Casts vs Splints

- Splints – acute Casts – after acute swelling
- Splints – quicker, cheaper, but have increased risk of complications
- Casts – more expensive, more training, better immobilization, comfort

Casting

- Casting involves circumferential application of plaster or fiberglass to an extremity.
- Therefore, they are usually reserved for complex and/or definitive fracture management.

General Indications

- Definitive management of simple, complex, unstable, or potentially unstable fractures
- Severe, nonacute soft tissue injuries unable to be managed with splinting

Ulnar Gutter Splint

- Indications
  - Soft-tissue hand injuries to the fourth and fifth fingers
  - Fourth and fifth metacarpal
  - Fractures of the fourth and fifth phalanges
- Contraindications
  - Complicated fractures
  - Open fractures
  - Injuries with associated neurovascular compromise

Ulnar Gutter Cast

- Indications
  - Second and third proximal/ middle phalangeal shaft fractures and select metacarpal fractures
- Contraindications
  - Complicated fractures
  - Open fractures
  - Injuries with associated neurovascular compromise

Radial Gutter Splint

- Indications
  - Second and third proximal/ middle phalangeal shaft fractures and select metacarpal fractures
- Contraindications
  - Complicated fractures
  - Open fractures
  - Injuries with associated neurovascular compromise

Radial Gutter Cast

- Indications
  - Second and third proximal/ middle phalangeal shaft fractures and select metacarpal fractures
- Contraindications
  - Complicated fractures
  - Open fractures
  - Injuries with associated neurovascular compromise

Thumb Spica Splint/Cast

- Indications
  - Scaphoid injuries
  - Lunate injuries
  - First metacarpal fractures
  - Injury to the ulnar collateral ligament (UCL)
  - Positioning for de Quervain tenosynovitis
- Contraindications
  - Complicated fractures
  - Open fractures
  - Injuries with associated neurovascular compromise

Buddy Taping

- Indications
  - Nondisplaced proximal/middle phalangeal shaft fracture and sprains
- Contraindications
  - Open fractures

Dorsal Extension Block Splint

- Indications
  - Middle phalangeal volar plate avulsions and stable reduced PIP joint dislocations
- Contraindications
  - Open fractures

Volar/Dorsal Forearm Splint

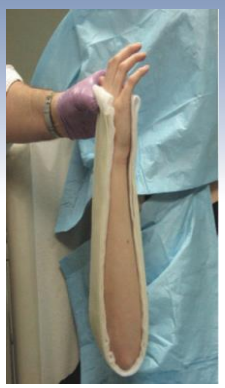
- Indications
  - Soft tissue injuries to hand and wrist
  - Acute carpal bone fractures (excluding scaphoid/trapezium)
  - Childhood buckle fractures of the distal radius
- Contraindications
  - Complicated fractures
  - Open fractures
  - Injuries with associated neurovascular compromise

Short-Arm Cast

- Indications
  - Nondisplaced, minimally displaced, or buckle fractures of the distal radius
  - Carpal bone fractures other than scaphoid/trapezium
- Contraindications
  - soft-tissue injuries accompanying fractures may be so severe as to make splinting for anything longer than a few hours impractical.
  - In cases of decreased ability to feel the skin (neuropathy), both splinting and casting can lead to skin breakdown without the patient realizing.

Single Sugar-Tong Splint

- Indications
  - Acute management of distal radial and ulnar fractures.
- Contraindications
  - Complicated fractures
  - Open fractures
  - Injuries with associated neurovascular compromise



Long Arm Posterior Splint/Cast

- Indications
  - Distal humeral and proximal/ midshaft forearm fractures
  - Non-buckle wrist fractures
- Contraindications
  - Multiple or complicated fractures
  - Open fractures
  - Injuries associated with neurovascular compromise

Double Sugar-Tong Splint

- Indications
  - Acute elbow and forearm fractures, and nondisplaced, extra-articular Colles fractures

Lower Body Casting

Posterior Ankle Splint

- Indications
  - Severe sprains Isolated, nondisplaced
  - Malleolar fractures
  - Acute foot fractures
- Contraindications
  - Complicated fracture
  - Open fractures
  - Injuries with associated neurovascular compromise

Ankle Stirrup Splint

- Indications
  - Ankle sprains
  - Isolated, nondisplaced malleolar fractures
- Contraindications
  - Complicated fracture
  - Open fractures
  - Injuries with associated neurovascular compromise

Short-Leg Cast

- Indications
  - Isolated, nondisplaced malleolar fractures Foot fractures—tarsals and metatarsals
- Contraindications
  - Complicated fracture
  - Open fractures
  - Injuries with associated neurovascular compromise

Posterior Knee Splint

- Indications
  - Acute soft tissue and bony injuries of the lower extremity
- Contraindications
  - Should not be worn for long periods of time.

Short leg cast with toe plate extension

- Indications
  - Isolated, nondisplaced malleolar fractures Foot fractures—tarsals and metatarsals
  - Distal metatarsal and phalangeal fractures

Clinical Question

- **Can utilization of non-circumferential pre-cut synthetic fiberglass and padded splints (I) help improve the healing outcomes (O) for adult patients or athletes who have an acute, non-complicated distal radius fracture (P)?**
- P: Adults patients or athletes who have an acute orthopedic forearm fracture.
- I: Non-circumferential pre-cut synthetic fiberglass and padded splints
- O: Improve healing outcomes

Literature Review

- Splints and casts: Indications and methods. (2009)
- Noncircumferential splints indicated for acute, non-complicated distal radius fracture
- Allows for acute swelling
- Decreases risk of complications
- Faster and easier application
- Can be static or dynamic

Literature Review

- A prospective randomized clinical trial comparing circumference casting and splinting in displaced Colles fracture. (2010)
- Compares 3 immobilization methods: circumferential casting , volar-dorsal splinting, and modified sugar-tong splinting
- Functional outcomes at 8 weeks were similar among casts
- Important trend of increased loss of reduction with the use of MST splinting
- Ease of application and familiarity with use should guide clinical decisions when choosing a dressing type for displaced Colles fractures

Clinical Question

- **Can utilization of non-circumferential pre-cut synthetic fiberglass and padded splints (I) help improve the healing outcomes (O) for pediatric patients or athletes who have an acute, non-complicated distal radius fracture (P)?**
- P: Pediatric patients or athletes who have an acute orthopedic forearm fracture.
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- Noncircumferential splints indicated for acute, non-complicated distal radius fracture
- Allows for acute swelling
- Decreases risk of complications
- Faster and easier application
- Can be static or dynamic
- Risk of lack of compliance

Literature Review

- Cast versus splint in children with minimally angulated fractures of the distal radius: a randomized controlled trial. (2010)
- Splint was as effective as a cast with respect to the recovery of physical function.
- No difference in the maintenance of fracture stability and the occurrence of complications between cast and splint
- Splint was superior to the cast in terms of parental and patient satisfaction and preferences.

Clinical Question

- **Can utilization of circumferential fiberglass short-arm cast (I) help improve the healing outcomes (O) for adult patients or athletes who have an acute, non-complicated distal radius fracture (P)?**
- P: Adult patients or athletes who have an acute orthopedic fracture
- I: Circumferential fiberglass short arm cast
- O: Improve healing outcomes

Literature Review

- Splints and casts: Indications and methods. (2009)
- Short arm cast indicated for nondisplaced, minimally displaced, or buckle fractures of the distal radius & carpal bone fractures other than scaphoid/trapezium.
- No difference in pain/healing rates compared to forearm splint.
- Increased compliance compared to splint

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- Important trend of increased loss of reduction with the use of MST splinting
- Ease of application and familiarity with use should guide clinical decisions when choosing a dressing type for displaced Colles' fractures

Clinical Question

- **Can utilization of circumferential fiberglass short-arm cast (I) help improve the healing outcomes (O) for pediatric patients or athletes who have an acute, non-complicated distal radius fracture (P)?**
- P: Pediatric patients or athletes who have an acute orthopedic fracture
- I: Circumferential fiberglass short arm cast
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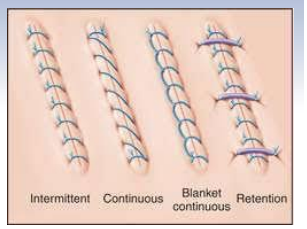
Casting & Fracture Care Answers

- 1) C. Higher risk of complication
- 2) B. Position of function
- 3) More effective immobilization
- 4) C. 4-6 inch
- 5) B. False
- 6) A. Complex fractures
- 7) A. 1-2 weeks
- 8) B. 24-48 hours
- 9) A. Decreased swelling
- 10) D. All the above

Topic #3 Skin Lacerations



Program Goals

- Identify the various types of common acute wounds and skin lacerations
- Identify and demonstrate the appropriate selection and application methods for various types of skin closures

Program Goals

- Identify the appropriate precautions and other considerations for the application of various types of skin closures
- Identify the appropriate contraindications for the application of various types of skin closures
- Identify the appropriate indications for the application of various types of skin closures

Program Goals

- Identify the various types of skin closures available for acute wounds and skin lacerations
- Review the appropriate evaluation methods for common acute wounds and skin lacerations
- Review the etiology of common acute wounds and skin lacerations

Laceration: A jagged edge cut, most commonly caused by direct or glancing blow.


Abrasion: scraping of the epidermis caused by friction


Puncture: A deep wound cause by direct penetrating trauma.


Burn: Injury caused by heat, cold, electricity, chemicals, friction, or radiation
Categorized as superficial, partial-thickness, or full-thickness


Burns

- Superficial Burns (1st degree)
  - Involve only the top layer of the skin, leaving top layer red and dry.
- Partial-Thickness Burns (2nd degree)
  - Involve the top layer of the skin, appearing as red and blistered.
- Full-Thickness Burns (3rd degree)
  - Destroys all layers of skin, fat, muscle, and nerves presenting skin as black.

Cleaning of Wounds

- Care for immediately to decrease the risk of infection.
  - Treat all as though they are contaminated
- For all bleeding victims, instruct patient to utilize sterile gauze for direct pressure while the clinician puts on gloves.
- Remove gauze from site for wound inspection
  - Foreign object/wound size/type
- Clean wound with soap/water or approved sterilizing solution
  - Hydrogen Peroxide

Laceration

- MC on upper eyelid/face or upper arm
  - Rinse with running water from proximal to distal end for cleaning.
  - If upper eye, utilize water and sterile gauze in same direction.
- Avoid scrubbing to prevent further damage
- Determine depth of laceration for referral
- Apply wound closure such as band aid/steri-strips
- Cover with non-adhesive bandage

Abrasion

- MC on knee/lower leg, forearm/elbow
- Scrub wound with small circular motions from center of wound outward
  - Removes foreign objects.
- Rinse wound with running water/approved wound cleaning solution
- Dry wound and apply anti-bacterial ointment
- If subject is returning to competition, cover with non adherent gauze/powerflex

Puncture

- In most cases, do not remove the foreign object.
  - Stop bleeding and transport if Medical Emergency.
- If the object is small, carefully remove the object.
  - Stop bleeding with firm direct pressure over wound.
- Clean with water/sterile solution to prevent further infection.
- Cover with sterile gauze and non-adherent bandage.

Burn Indications

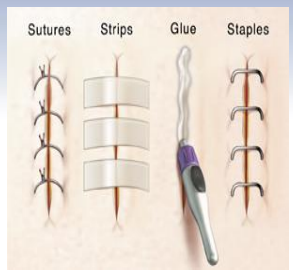
- Cool burn with large amounts of cool/cold water
- Remove affected area from source of burn
- Cover burns loosely with sterile gauze

Burn Contraindications

- Do not apply or ice water to any burns
- Do not touch the burn with anything but clean covering
- Do not remove pieces of burned clothing stuck to area
- Do not clean severe burns
- Do not break blisters
- Do not use any ointment on severe burns

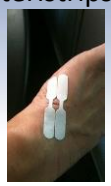
Skin Closure Methods

- Butterfly stitches
- Dermabond
- Sutures
- Staples
- Superglue
- Steristrips



Skin Closure Method: Butterfly/Steristrips

- Indications
  - High quality alternative to staples for minor cuts and wounds
  - Minor cuts and wounds without presence of infection
- Contraindications
  - Size of the wound is too large and requires a different skin closure method
  - Infection is present



Skin Closure Method: Butterfly/Steristrips

- Line up the edges of the wound
- Push wound edges together, starting in the middle of the wound, apply strips
- Place half of the strip on one side of the wound and bring the other side of the wound to it, place the other half of the strip down.
- Place strips alternatively above and below the first strip
- To anchor strips, place two strips vertically across each row.

Skin Closure Method: Dermabond

- Indications
  - Tissue adhesives are equally effective for low-tension wounds with linear edges that can be evenly approximated.
  - Less painful and require smaller amounts of time to apply
- Contraindications
  - Not recommended for wounds with complex jagged edges or for those over high-tension areas (e.g., hands, joints)

Skin Closure Method: Dermabond

- Inspect the wound for foreign bodies/infection/size
- Apply direct pressure to stop bleeding.
- After bleeding has stopped, place dermabond along the wound with the applicator facing the wound.
- Attempt to line the edges of the wound as symmetrical as possible.
- Once glue has dried, apply dermabond along the length of the wound to ensure closure.

Skin Closure Method: Sutures

- Indications
  - Unable to stop the bleeding due to the size and nature of the wound
  - Concerns about scarring (especially on the face)
    - stitched wounds tend to heal more cleanly
  - Exposure of muscle (dark red) or fat (yellow) through the injured site.

Skin Closure Method: Sutures

- Contraindications
  - Guidelines recommend primary closure of wounds that are clean and have no signs of infection within six to 12 hours of the injury. No more than 24 hours
  - Bite wounds

Nylon

- Most common

Silk

Polypropylene

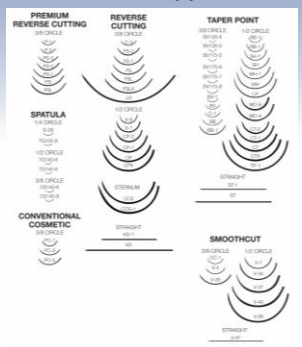
Polyester

Sizes of Sutures

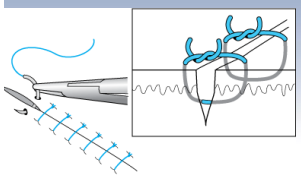
U.S.P. SUTURE SIZES CHART

U.S.P. Size	COLLAGEN SUTURES		SYNTHETIC SUTURES	
	Metric Size	Diameter Range	Metric Size	Diameter Range
# 7	-	-	9	0.900 - 0.999
# 6	-	-	8	0.800 - 0.899
# 5	-	-	7	0.700 - 0.799
# 4	8	0.800 - 0.899	6	0.600 - 0.699
# 3	7	0.700 - 0.799	6	0.600 - 0.699
# 2	6	0.600 - 0.699	5	0.500 - 0.599
# 1	5	0.500 - 0.599	4	0.400 - 0.499
# 0	4	0.400 - 0.499	3.5	0.350 - 0.399
# 2-0	3.5	0.400 - 0.399	3	0.300 - 0.339
# 3-0	3	0.300 - 0.339	2	0.200 - 0.249
# 4-0	2	0.200 - 0.249	1.5	0.150 - 0.199
# 5-0	1.5	0.150 - 0.199	1	0.100 - 0.149
# 6-0	1	0.100 - 0.149	0.7	0.070 - 0.099
# 7-0	0.7	0.070 - 0.099	0.5	0.050 - 0.069
# 8-0	0.5	0.050 - 0.069	0.4	0.040 - 0.049
# 9-0	0.4	0.040 - 0.049	0.3	0.030 - 0.039
# 10-0	-	-	0.2	0.020 - 0.029

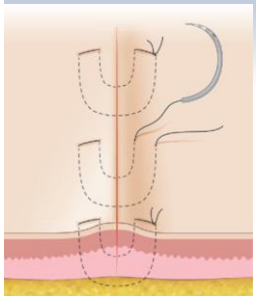
Needle Types

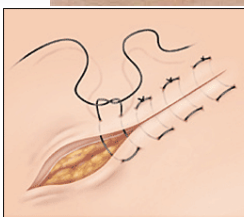


Simple Interrupted

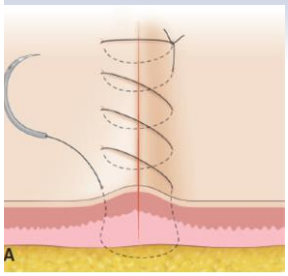


Vertical Mattress





Simple Running



Skin Closure Method: Staples

- Utilize a local anesthetic to provide pain control for patients
- Irrigate the wound and remove any foreign bodies/necrotic tissue.

- Procedure
  - Using forceps, to approximate the skin margins
  - Without indenting the skin, firmly press the stapler against the skin/eject staple into skin.
  - Place stapes 0.5-1.0 cm apart
  - After application, apply antibiotic ointment and apply a dressing if on the leg, arm, or trunk.

Skin Closure Method: Staples

- Indications
  - For minor wounds when more effective than sutures.
  - Most commonly seen with linear lacerations and straight edges
  - Use primarily on scalp, trunk, arms, and legs.
- Contraindications
  - Areas around the face/eyes
  - Staples should be used in a time where skin closure needs to be expedited.

Skin Closure Method: Superglue

Clinical Question

- **Can immediate utilization of synthetic, monofilament suturing materials (I) help improve the healing outcomes (O) for patients or athletes who have an acute, non-complicated low-tension skin laceration(P)?**
- P: Patients or athletes who have an acute, non-complicated low tension skin laceration.
- I: Immediate utilization of synthetic, monofilament suturing materials
- O: Improve healing outcomes

Literature Review

- Suture Choice and Other Methods of Skin Closure. (2009)
- Monofilament sutures express strength, low tissue-drag, and low tendency to cause infection
- Monofilament sutures do not handle as easy as braided sutures.
- Plain, chromic and fast-absorbing plain
  - Less tensile strength than plain gut of comparable size. Fast-absorbing plain gut is used primarily for epidermal suturing where sutures are required for only 5 to 7 days.

Clinical Question

- **Can immediate utilization of synthetic, monofilament suturing materials (I) help improve the healing outcomes (O) for patients or athletes who have an acute, non-complicated high-tension skin laceration(P)?**
- P: Patients or athletes who have an acute, non-complicated high-tension skin laceration.
- I: Immediate utilization of synthetic, monofilament suturing materials
- O: Improve healing outcomes

Literature Review

- Suture Choice and Other Methods of Skin Closure. (2009)
- Monofilament sutures express strength, low tissue-drag, and low tendency to cause infection
- Monofilament sutures do not handle as easy as braided sutures.
- Polypropylene (Prolene)
  - high tensile strength, similar to nylon
  - high plasticity, and ability to accommodate wound edema.

Clinical Question

- **Can immediate utilization of liquid tissue adhesive (I) help improve the healing outcomes (O) for patients or athletes who have an acute, non-complicated low-tension skin laceration(P)?**
- P: Patients or athletes who have an acute, non-complicated low tension skin laceration.
- I: Immediate utilization of synthetic, monofilament suturing materials
- O: Improve healing outcomes

Literature Review

- Suture Choice and Other Methods of Skin Closure. (2009)
- 2-0ctylcyanoacrylate (Dermabond).
  - Compared with sutures, staples, and tapes, adhesives provide faster closure
  - Advantages include: reduced cost, ease of application, absence of needles and suture removal, and higher rate of patient satisfaction;
  - Major disadvantages include: lack of strength.

Clinical Question

- **Can immediate utilization of liquid tissue adhesive (I) help improve the healing outcomes (O) for patients or athletes who have an acute, non-complicated high-tension skin laceration(P)?**
- P: Patients or athletes who have an acute, non-complicated high-tension skin laceration.
- I: Immediate utilization of synthetic, monofilament suturing materials
- O: Improve healing outcomes

Literature review

- Suture Choice and Other Methods of Skin Closure. (2009)
- 2-0ctylcyanoacrylate (Dermabond).
  - Compared with sutures, staples, and tapes, adhesives provide faster closure
  - Advantages include: reduced cost, ease of application, absence of needles and suture removal, and higher rate of patient satisfaction;
  - Major disadvantages include: lack of strength.
  - Should not be used for wounds in mucous membranes, contaminated wounds, deep wounds, or wounds under tension.

Clinical Question

- **Does utilization of tap water (I) help improve wound healing outcomes (O) for patients or athletes who have an acute, non-complicated skin laceration?**
- P: Patients or athletes who have an acute, non-complicated skin laceration
- I: Utilization of tap water
- O: Improve wound healing outcomes

Literature Review

- The influence of tap water upon a wound as been proven efficient by being more efficient, cost-effective, and accesible in a sytematic review. 2012
- Tap water should not be used to cleanse wounds on tendons or bones.

Clinical Question

- **Does utilization of a normal saline solution (I) help improve the wound healing process (O) for patients or athletes who have an acute, non-complicated skin laceration?**
- P: Patients or athletes who have an acute, non-complicated skin laceration
- I: Utilization of a normal saline solution
- O: Improve healing process

Literature Review

- The influence of normal saline is considered most appropriate as a cleansing solution for acute skin trauma, including tendon and bone exposures by an evidence based systematic review. 2012
- Normal Saline was used at room temperature when compared to tap water at 98.6° F

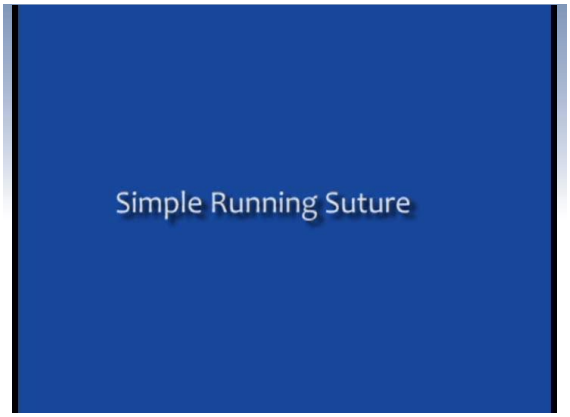
Wound Care & Skin Closure Answers

- 1) A. True
- 2) C. Up to 24 hours
- 3) A. Laceration
- 4) D. Nylon
- 5) A. Simple interrupted
- 6) B. False
- 7) A. 5-0
- 8) C. All of the above
- 9) A. True
- 10) B. Occlusive

Instrument Tie

Simple Interrupted Suture

Vertical Mattress Suture


Simple Running Suture