Soft Tissue Injuries Management

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MOIs for Soft Tissue Injury

Soft tissue injuries can occur through:

- Blunt injury
- Penetrating injury
- Barotrauma
- Environmental sources
- Burns

Soft tissue injuries are most common body injury. Can lead to death if complicated by hemorrhage or infection.
Pathophysiology

- Wound occurs with/without hemorrhage
- Inflammation occurs
- New cells move into damaged area
- New blood vessels may form
- Collagen increases stabilizing damaged tissue and joining wound borders
Soft Tissue Injuries

- Burns
- Closed
  - Contusion
  - Hematoma
  - Crush injuries
- Open
  - Abrasion
  - Laceration
  - Avulsion
  - Penetration
  - Puncture
  - Amputation
  - Crush injuries
Closed Injuries – Blunt Injury

- Contusion (bruise)
  - Epidermis remains intact
  - Ecchymosis

- Hematoma
  - Larger vessels are damaged
  - Collection of blood beneath skin
Closed Injuries – Blunt Injury

- Crush Injury (may be combo closed & open)
  - Possible organ rupture
  - Internal bleeding/Shock

- Extent of damage from crush injury depends on amount of force and time duration (>4 hr can cause crush syndrome as swelling compacts nerves and blood vessels.)

Treatment: usually not needed for minor closed injuries but crush injuries should be evaluated at a hospital
Open Injuries

- Skin is ‘broken’
- Bleeding control may be needed
- Much more likely to be contaminated with later infection and further tissue damage
Types of Bleeding

- **Arterial**: bright red, spurts blood
- **Venous**: dark red, steady flow
- **Capillary**: dark red, oozes blood
To Control Bleeding:

- Take precautions!
- Direct pressure
- Pressure dressing
- Tourniquet
Non-Commercial Tourniquets

- At least 4 in wide/6-8 layers deep
- Apply proximal to wound as close as possible (not over a joint) or high on limb if commercial tourniquet
- Wrap twice & tie with 1 knot
- Tighten (with stick) til bleeding stops
- Note time & TK on patient’s forehead
- Do not loosen or remove unless directed
- May use BP cuff pumped to above systolic pressure
Non-Commercial Tourniquet Application
Commercial Tourniquets

- Follow manufacturer’s guidelines
- Apply tourniquet proximal to site of the hemorrhage - usually 1 to 3 inches above the site
- Goal is to have tourniquet in-place & controlling bleeding within 60 seconds
Tourniquet Application

- Ensure tourniquet is tight enough to occlude distal pulses
- Leave tourniquet visible whenever possible – do not cover up with clothing
- Frequently re-check to determine if bleeding has restarted
  - Blood soaking through dressings/bandages
  - Continued bleeding distal to the tourniquet
  - Do not remove tourniquet or dressings to assess for bleeding
- If bleeding is still not controlled
  
  - Apply a second tourniquet
  
  - If first tourniquet is below the knee, place the second tourniquet 1 – 3 inches above the knee.
  
  - If first tourniquet is above the knee, place the second tourniquet 1 – 3 inches proximal to the first tourniquet.
Hemostatic Gauze

- If severe bleeding persists from the trunk, neck, head or other location where a tourniquet cannot be used, hemostatic gauze dressings should be used.

- Can be commercial product or may be done with Kling-type roller gauze
Abrasions

- A scratch or “rugburn”
- Outermost layer of skin is damaged
- Superficial
- Bleeding from small veins and capillaries

- Treatment: sterile dressing +/- antibiotic ointment
Lacerations/Incisions

- Lacerations (jagged); Incisions (straight)
- Depth may vary.
- Linear (regular/smooth edges)
- Stellate (irregular/jagged edges)
- Bleeding may be severe

Treatment:
- sterile dressing +/- antibiotic ointment
- butterfly strips, stitches, staples
- tetanus shot
Laceration Repair

Goals of Laceration Repair:

- Achieve homeostasis
- Avoid infection
- Minimize Scarring
Prompt closure decreases risk of infection and improves cosmesis.

Many wounds can be closed up to 19 hours after injury.
Cleaning the Open Wound

Tap water is acceptable

Irrigation with mild pressure (less forceful on face as debridement of subQ fat may cause dimpling at the site.

Clean technique
Laceration Repair Technique

Single layer repair has similar cosmetic results compared to multilayer repair.

- faster
- less expensive
- better tolerated by the patient
- including facial lacerations
Laceration Closure Techniques

Sutures
Staples
Hair apposition
Steri-strips/closure tape
Tissue adhesive
Preparing site for wound closure

Anesthetic may be needed for exploration of the wound and closure.

Topical preparations are available, used more in children, must wait 1-4 hours for effect. (Lidocaine/prilocaine)

Injectable Lidocaine, with or without epinephrine
Types of Suture Material

Face: Nylon (Ethilon or Prolene) 5.0 or 6.0

Extremities: Nylon 4.0

Mucosa: Absorbable 4.0
   (Chromic, Monocryl, or Polydioxanone)
Laceration of Lip

3.0 or 4.0 absorbable on lip and 6.0 or 7.0 nylon on skin

Difficult to suture over the vermilion border: place first stitch on the border and Mark the border BEFORE anesthetizing.
Lacerations Near Eye

Refer to Ophthalmology: anything involving eye itself, eyelid margin, deeper than subQ, or tarsal plate

6.0 Nylon Suture

Do not shave eyebrow to place sutures (eyebrow shape provides landmark guide)
Ear Lacerations

Cartilage tissue has poor circulation

Hematoma likely- To achieve adequate pressure may gauze wrap around head.
Scalp Lacerations

Hair apposition: highest patient satisfaction, lowest cost

Staples: Ease of use, good results, inexpensive and fast, easy removal

Hands and Arms

Sutures: Nylon 4.0 or 5.0

Subungual hematomas:
Trephining can be effective even if > 25% nailbed affected

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2377229/
» Mouth heavily contaminated with virulent bacteria
» Wounds may require antibiotics, tetanus prophylaxis or suturing
» Rabies spread through bites or licking open wounds. Affects any warm-blooded animal. Causes potentially fatal viral infection of CNS – treated by series of injections
Bite Wounds

20% of bite wounds become infected

New Evidence: dog bite repairs, especially on the face, should be repaired

Cat bites, higher rate of infection, better results if not sutured UNLESS the bite is on the face.
Tissue Adhesives Criteria

- <12 hours
- Linear (not star shaped)
- Bleeding controlled
- Not over a joint
- Not crossing mucous membrane
- Not in an area with hair growth
- Not under tension
- Not grossly contaminated
- Not infected
- Good perfusion
- Not a bite
- No chronic condition which affects healing

https://www.aafp.org/afp/2017/0515/p628.html table 3
Wound adhesive strips

“Steri strips”
Can be very effective, easy to apply, must approximate wound edges well, avoid disrupting the tape
Patient education, trim the tips when they pull off or are dirty from the distal tips and do not pull off, will separate themselves when ready.
Care after Lac Repair

May bathe 12 hours after

Topical antibiotics should be applied, prefer bacitracin over neomycin, over sutures

Keep wound moist
<table>
<thead>
<tr>
<th>Location</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face</td>
<td>3-5 days</td>
</tr>
<tr>
<td>Scalp</td>
<td>7-10 days</td>
</tr>
<tr>
<td>Arms</td>
<td>7-10 days</td>
</tr>
<tr>
<td>Trunk</td>
<td>10-14 days</td>
</tr>
<tr>
<td>Legs</td>
<td>10-14 days</td>
</tr>
<tr>
<td>Hands or Feet</td>
<td>10-14 days</td>
</tr>
<tr>
<td>Palms or Soles</td>
<td>14-21 days</td>
</tr>
</tbody>
</table>
Tetanus

Tetanus shot if > 5 years for any Deep or Contaminated wound (including bite)

Tetanus shot if > 10 years since last shot if a clean and superficial wound.

If no documentation, err on the side of caution.
Amputations

- The surgical or traumatic severing of a body part.
- Usually an extremity or extremity part.
- **Never** complete a partial amputation!
Amputation

- Control bleeding of stump
  - Direct pressure
  - Tourniquet
- Locate and Transport Amputate with Patient
  - Clean
  - Wrap in sterile, moist gauze - place in plastic bag
  - Place bag on crushed ice (do not freeze)
- Transport to appropriate resource hospital
Avulsions

- A piece of skin that is forcibly separated or torn loose or pulled off by injury
  - Forearms, legs, feet
  - The ears, nose
  - Fingers, toes
  - The eyes

Treatment: sterile dressing +/- antibiotics
Impaled Objects

- Object causes puncture wound and object is still embedded
- Do not remove, stabilize!!!

Exceptions =>
  » the cheek!
  » interference with chest compressions!
Wounds to the Neck

- Danger of air embolism
- Compress carotid artery (only just one side & only if necessary to control bleeding).
- Occlusive dressing = airtight (Tegaderm, plastic wrap over sterile dressing material)
Burn Epidemiology

- 2 million people/year receive burn injuries
- 70,000 hospitalized
  » 5% of hospitalized patients die (most have flame burns)
- Highest incidence 20-29, followed by children under 9
- 67% of serious burns in males
Pathophysiology

Severity of a thermal wound based on:

– Temperature/amount of heat energy possessed by object/substance
– Concentration of chemical
– Duration of exposure
Burn Severity

- Severity of Burn depends on:
  - Extent, depth, and location of burn injury
  - Age of patient
  - Etiologic agents
  - Presence of inhalation injury
  - Coexisting injuries or pre-existing illnesses
Patient Categorization

- Major Burns – Burn Center needed:
  - Chemical burns
  - High voltage
  - Burns with inhalation injury or major trauma
  - Burns in High risk patients
Types of Burns

- Scalds (liquid and steam)
- Contact
- Fire (flash and flame)
- Chemical
- Electrical
- Radiation
Types of Burns

- Severe Burn Injuries
  - Flame burns 37%
  - Scalds (liquids) 24%
  - Scalds (grease) 8%
  - Contact 7%
  - Flash burns 7%
  - Chemical burns 5%
  - Electrical burns 5%
  - Scalds (steam) 2%
Flame Burns

- Structure fires, matches, fireplaces, grills, campfires most common causes.
- Inhalation injuries frequent
Inhalation Burns

Signs of inhalation burns:

- Soot around mouth or nose
- Singed nasal hairs
- Respiratory distress signs such as rapid, shallow or noisy breathing, hoarseness or retractions
- Swollen or reddened tongue or throat
Contact Burn

- Skin contact with hot objects such as irons, curling irons, radiators, lamps, heaters, ovens, etc.
Scald Burns

- Hot liquids or steam
- 34% of severe burns
- Burns to head, upper extremities, chest, thighs most common
- Slow to blister - tend to underestimate
Radiation Burns

- Most often due to sunburn. May be due to Xray exposure
- Usually 1st degree, sometimes 2nd degree. May take hours to days to be fully evident
- 40% or more 1st degree burn serious in young infant or toddler
Ionizing Radiation Burns

- Three types of ionizing radiation:
  - Alpha - little penetrating energy, easily stopped by the skin
  - Beta - greater penetration blocked by simple protective clothing
  - Gamma - very penetrating, easily passes through the body and solid materials

- Keys are source/type, duration, distance shielding – protect yourself
Electric Burns

- Small surface burn; more widespread damage in deeper layers.
- May affect muscle or fat layers
- Small child more often due to biting cords or sticking objects into sockets.
Electrical Burns

- Small surface burn may hide larger area of severe burn or fracture beneath
- Burn Center recommended
- Danger of arrhythmia or seizures if high voltage, especially if due to lightning
Chemical Burns

- Skin contact, eye splashes or ingestion of caustic substance
- Acids, bases, mace/pepper spray cleaning products
- Often deeper than may look on the surface
Alkali Burns
ABCs

Airway – inhalation injuries, edema, stridor
Breathing – bronchospasm, wheezing
Circulation – arrhythmias, carbon monoxide poisoning
Focused History

Check history of:

- Closed space confinement with smoke
- Chemical ingestion or exposure
- Length of exposure & time elapsed
- Possibility of other trauma (10% of patients)
- Pre-existing medical conditions
Detailed Physical Exam

Primary and Secondary Survey:

- Burn location - particularly on face or chest
- Soot around nose / mouth or sooty secretions
- Swelling of tongue, mouth, nose
- Continual cough or hoarseness
- Signs of fracture or internal injury
Assessment of Burns

- Extent - % of patient’s total body surface
- Depth - degree of burn
- Location - especially burns of face, genitals, rectal area, hands, feet, or major joints. Also if burn encircles arm, leg or chest
- Special circumstances - high voltage burns, blast injuries, falls, chemical burns, especially if inhaled or swallowed
Burn Wound Assessment – Rule of Nines - Adult

- Practical Technique for estimating the extent of BSA involved
  - 9% for head/neck & each upper ext
  - 18% anterior trunk, posterior trunk, each lower ext
  - 1% genitalia
<table>
<thead>
<tr>
<th>Age Group</th>
<th>&lt;1</th>
<th>1-8</th>
<th>&gt;8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>18%</td>
<td>12%</td>
<td>9%</td>
</tr>
<tr>
<td>Chest/Back (each)</td>
<td>18%</td>
<td>18%</td>
<td>18%</td>
</tr>
<tr>
<td>Arm (total per arm)</td>
<td>9%</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>Leg (total per leg)</td>
<td>13.5%</td>
<td>16.5%</td>
<td>18%</td>
</tr>
<tr>
<td>Genitalia</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>
Rule of Palms

- For small or irregular burns - estimate how many times the surface area of the child’s palm would fit over the burned area.
- Multiply number of times by 1% - ex. if palm would fit 3 times = 3% of child’s total body surface area

*Figure 20: Rule of Palms
Child's palm equals approximately 1% of total body surface area*
Superficial Burns (1st Degree)

- Outer epidermis layer only
- Redness - no blistering
- Sunburn most common cause
- Usually do not need treatment but burn ointments may help decrease pain
Partial Thickness Burns (2nd Degree)

- Partial thickness - outer skin (epidermis) & some inner skin (dermis)
- Redness & blisters
- Broken blisters red, moist & painful; skin sloughing
- Scald most common cause.
Full Thickness Burns (3rd Degree)

- Full thickness of skin & subcutaneous tissue; may involve muscle or fat
- May be white/pale or black/charred
- Painless due to nerve ending destruction
- Contact or flame burns most common
4th & 5th Degree Burns

- 4th degree burns – full thickness with destruction of underlying muscles & fat layers. More common in chemical burns.

- 5th degree burns – destruction of bone. More common in some chemical (especially hydrofluoric acid) and radiowave burns.
Burn Management

- Treat burn shock with IVF, shock position
- Immerse wound in cold water if possible long enough to stop burning process
  - Initiate ASAP, no benefit shown if started after 30 min
  - No ice directly on burn – frostbite
  - Cold: inhibits lactic acid production (CV stability), inhibits histamine release (edema, 3rd spacing)
Burn Management

- Remove clothing unless stuck to burned area, and jewelry in area of burn. Remove contact lens if patient has altered mental status.
- Cover the burned area with dry sterile dressing or burn sheet to decrease pain and protect injury.
- Cover patient with blanket as appropriate to maintain body temperature.
Chemical Burn Management

- Brush dry chemicals from skin with towel, gloved hand, etc.
- Remove any clothing in contact with chemical
- Flush skin with large amounts of water for up to 20 minutes
- Cover patient when above treatment complete
- Pain management if available
Chemical Eye Burn Management

- Continuous flushing with normal saline for 10-20 minute
- Always flush from midline out to edges – especially if only 1 eye affected
- May use nasal cannula connected to IV saline drip
Burn Transport Protocols

Strongly consider burn center for the following burns:

- Burns compromising patient’s airway
- Burns of face, hands, feet, joints, perineum, genitalia
- Circumferential burns
- > 10% total partial thickness burns
- Any 3rd degree burns
- Electrical burns or significant chemical burns
- Co-existing risk factors such as diabetes, heart disease, or respiratory problems

Burns with concomitant trauma (may go to trauma center first)
Questions ????
Follow up wound care

Careful Assessment and follow up based on type of wound and severity

Watch for signs and symptoms of infection.
General principles: avoid trauma to healing wound (except when debriding), support body’s natural healing process, maintain moisture.

For puncture wounds, especially of feet or hands, osteomyelitis can occur after superficial healing has occurred. Educate patients and monitor for bone or joint pain, stiffness, even if no signs of skin infection
Topical Antibiotics

Avoid Neosporin. Preferred: bacitracin or bacitracin with polymyxin (polysporin)

For superficial injuries without high risk of infection, petroleum jelly can be used to keep wound moist and provide barrier.
Judicious Use of Antibiotics

Based on wound location and type of wound.

In superficial wounds, no evidence for value of “prophylaxis” other than as previously mentioned.

Good wound care at the site can mitigate the need for antibiotics. Keep wounds Moist!

Antiseptics to consider: iodine-based, silver infused dressings, honey (available in medical creams)

Other alternatives: beta-blockers (emerging evidence in burn wounds)
Special cases for Antibiotics

Feet: Puncture wounds antibiotic choices limited. Need to cover for P.aeruginosa and S.aureus. Cipro AND cefazolin, if allergic or resistant requires parenteral coverage.

Deep wounds/amputations/significant burns:
Require broad-spectrum coverages, Antibiotics in these cases would have been initiated in hospital setting based on cultures and sensitivities. Increase in rates of fungal infections have been seen, likely related to antibiotic overuse for prophylaxis in recent decades.