Acute Soft Tissue Injuries

Classic Soft-Tissue Injury
Response Sequence:
- inflammatory phase
- proliferative phase
- maturation phase

Inflammation
- pathologic process consisting of dynamic complex of cytologic & histologic reactions that occur in affected blood vessels & adjacent tissues in response to an injury...
**Classic Injury & Healing Phases**

- **Inflammatory phase** is critical period (2hrs – 6 days)
- First 72 hours important
- Poor management may lead to long term adverse sequelae

**Inflammation, Proliferation & Remodeling**

<table>
<thead>
<tr>
<th>Hour</th>
<th>Days</th>
<th>Weeks</th>
<th>Months</th>
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<tbody>
<tr>
<td>Bleeding</td>
<td>Inflammation</td>
<td>Proliferation</td>
<td>Remodeling</td>
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**Classic Acute Management**

- Relative rest
- Ice
- Compression
- Elevation

**Avoid H.A.R.M**

- Heat
- Alcohol
- Run
- Massage
Classic S&S of Inflammation

- Pain
- Swelling
- Redness
- Heat
- Dysfunction

Soft-Tissue Injury & Healing

- Vascular Response
  - Platelets
  - Fibrin meshwork
  - Capillary dilation
- Inflammation
  - Neutrophils
  - Macrophages
  - Lymphocytes
- Proliferation
  - Fibroblasts
  - Collagen deposition
  - Angiogenesis
- Maturation
  - Scar maturation

Inflammatory Phase

- Accumulation of clotting blood, serum fluid & necrotic tissue
- Migration of cells to area:
  - Erythrocytes
  - Leukocytes
  - Lymphocytes
  - Monocytes & Macrophages
  - Fibroblasts towards end
**Cellular Activities**

**Inflammatory Phase**

- **Vascular Changes**
  - Vasodilatation mediated initially by histamine
  - Continued by serotonin, prostaglandin, bradykinin
  - Increased capillary permeability by bradykinin
  - Proliferation of capillary endothelial buds

**Prepatellar Bursitis**

- **Oedema & increased water content**
- **Collagen**
  - Increased content
  - Increased turnover
  - Type 3 > Type I
  - Increased GAG & DNA

**Olecranon Bursitis**
**Proliferation & Remodeling Phases**

**Proliferation**
- Angiogenesis
- Fibroblasts: collagen; ECM - glycoproteins, glycosaminoglycans, proteoglycans, elastin, fibronectin
- Progressive fibroblast apoptosis

**Maturation & Remodeling**
- Type III collagen degraded replaced by type I collagen
- Disorganized fibers rearranged, cross-linked aligned (tension lines)

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**Classic S&S of Inflammation**
- Pain
- Swelling
- Redness
- Heat
- Dysfunction

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**Redness & Warmth**
- Chemical release
  - Histamine
  - Substance P
- Vasodilation
- Increased blood supply
- Within several hours
Pain

- Trauma
- Cell hypoxia
- Chemical release
  - Bradykinin
  - Prostaglandin
  - Histamine
- Pressure on nerve endings

Role of CNS in Pain & Injury

Swelling

- Bleeding
  - minimal, rarely arterial
  - distorts tissue and clots
- Chemical release
  - serotonin, leukotrienes, histamine, prostaglandin
  - increase cell membrane permeability
- Osmotic gradient
  - high concentration of extracellular protein draws fluid into extracellular space and increases oedema
- Lymphatic stasis
  - blocked by thick exudate

Acute swelling
(within 2hrs – 4 ds)
Clinical Aspects of Inflammation

- Characterised by
  - fluctuating swelling
  - functional limitation

- Management
  - reduce local tissue temp / reduce pain
  - limit / reduce inflammatory exudate
  - reduce metabolic demands of tissue
  - protect from further injury
  - protect newly-formed fibrin bonds
  - promote collagen fibre growth & realignment
  - Maintain CV / MSK fitness

Classic Soft-Tissue Injury Management

- Rest, Ice, Compression, Elevation
- Exclude
  - severe pain, immediate/profuse swelling, deformity, extreme loss of function, unusual/false motion, noises at injury site
- Acronyms
  - RICER / ICER
  - ICE / PRICER

R.E.C.I.P.E

- Relative Rest
- Elevation
- Compression
- Ice
- Pain Limited
- Exercise
Relative Rest

Clinical Objectives
- protect / prevent further injury
- reduce pain
- balance immobilisation to maintain anatomical alignment of injured structures with mobilisation to reduce atrophy effects

Early Mobilisation vs Immobilization

Soft-Tissue Hysteresis & Creep
**Elevation (Justifications)**

- reduce capillary pressure
- assist lymphatic drainage
- prevent accumulation / assists dispersal of inflammatory exudate
- reduce tissue pressure / pain (when due to increased pressure)
- intra-arterial pressure reduced
- elevation alone effective in reducing oedema

**Elevation: Guidelines / Contraindications**

- compression should be removed when limb elevated
- caution with acute compartment syndrome
- rebound phenomenon (dependent limb position following elevation)

**Compression (Justifications)**

- increase hydrostatic pressure of interstitial fluid:
  - counteracts osmolarity drive
  - facilitates lymphatic & venous drainage
  - prevent accumulation of oedema / assists in dispersal
- inhibit seepage, disperse fluid
- Airaksinen et al ('90) – RCT @ 1wk & 4wk compression group had less oedema / pain, increased ROM / improved function
Compression Guidelines / Contraindications

- distal to proximal
- applied in spiral fashion
- check for diminished circulation
- acute compartment syndrome
- too much pressure counterproductive

Ice (Justifications)

- inexpensive & widely used therapeutic modality
- decrease pain
- decrease metabolism
- decrease swelling
- decrease muscle spasm
- decrease circulation
- effects on inflammatory process

Ice & Sport Participation

- pain reduction after cooling 10-15deg
- reduce motor/sensory nerve conduction
- decrease blood flow
- decrease local blood flow
- decrease soft-tissue blood flow
**Ice Precautions**

- skin health / diseases
  - diabetes
  - chronic corticosteroid use
  - PVD
- prior adverse reactions
- cold adverse
  - Raynaud’s phenomenon
  - blue/white (cold) extremities
- pain / excess cold on application

**Ice Guidelines**

- not overly cold
  - 20-25°C not 5-15
- duration
  - until numb <15minutes
- re-apply
  - sensation / temp normal
- remove
  - excessive pain in first min’s
to avoid skin burn
- don’t apply to fractures,
open wounds (infection),
dislocations

**Pain Limited Exercise**

- facilitate lymphatic / venous drainage
- assist phagocytosis
  - reduce swelling
- increase deep blood supply
  - assist regeneration
- facilitate appropriate architecture of collagen bundle
  - functional healing scar tissue
Pyramid of Recovery

Return to Participation
Motor Re-Learning
Endurance
Proprioception
Flexibility  Strength

Inflammation or Degeneration in Sports Injuries?

-itis:
  ✷ Inflammation
  ✷ e.g., tendinitis
  ✷ “acute”

-osis:
  ✷ degeneration (diseased)
  ✷ e.g., tendinosis
  ✷ “chronic”