Sports Injuries and Conditions
Sports Injuries and Conditions

- Commonly encountered sports injuries and conditions include:
  - Fractures
  - Concussion
  - Bleeding
  - Joint injuries
  - Soft tissue injuries
    - Muscle injuries
    - Tendon and ligament injuries
  - Skin damage
  - Dehydration
  - Hyperthermia (heat stroke) and hypothermia
What is Injury?

• Injury = cellular damage,

• Local network of blood vessels is damaged,

• Damaged vessels bleed,

• Lack of oxygenated blood = cell death,

• Injured soft tissues consist of dead cells, extracellular substance and blood.

Injury Classification

• **ACUTE**: rapid onset, traumatic event with a clearly identifiable cause.
• **SUB-ACUTE**: period between acute and chronic, usually 4-6 weeks post-injury.
• **CHRONIC**: slow insidious onset, gradual development of structural damage.

Clark, 2004
Inflammation

• Heat:
  – Increased blood flow to the injured area causes an increase in temperature;

• Redness:
  – With increased perfusion comes a red/pink hue to the skin;

• Pain:
  – Caused by chemicals released by dying cells acting on nerve endings;

• Swelling:
  – Increases in blood flow and extracellular fluid - inflammatory exudate.

Evans 1994, ACPSM 1999
Repair and Regeneration

- Healed tissue never returns to pre-injury state
- Fibrous connective tissues will be replaced but will not have the same structural properties;
- Damaged muscles heal by scar tissue;
- Joint capsules thicken when healing due to the high levels of fibrin in the exudate;
- Generally soft tissues heal by fibrous repair.
Healing

- You cannot accelerate the healing process.
- We can provide optimum conditions for healing to occur;
- Reduce limiting factors.

- Limiting factors
  - Oedema
  - Haemorrhage
  - Poor vascular supply
  - Separation of tissues
  - Muscle spasm
  - Muscle atrophy
  - Infection
  - Health, age, nutrition
# Classification of sporting injuries

<table>
<thead>
<tr>
<th>Site</th>
<th>Acute Injuries</th>
<th>Overuse Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone</td>
<td>#, periosteal contusion</td>
<td>Stress #, “bone strain”, “stress reaction”, osteitis, Periostitis, apophysitis</td>
</tr>
<tr>
<td>Articular Injury</td>
<td>Osteochondral/chrondral #’s, Minor osteochondral injury</td>
<td>Chondropathy (e.g. softening, fibrillation, fissuring, chrondromalacia)</td>
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<tr>
<td>Joint</td>
<td>Dislocation, Subluxation</td>
<td>Synovitis, Osteoarthritis</td>
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<tr>
<td>Ligament</td>
<td>Sprain/tear (grades I-III)</td>
<td>Inflammation</td>
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<tr>
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<tr>
<td>Muscle</td>
<td>Strain/tear (grades I-III), contusion, cramp, acute compartment syndrome</td>
<td>Chronic compartment syndrome, DOMS, Focal tissue thickening/fibrosis</td>
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<tr>
<td>Tendon</td>
<td>Tear (complete/partial)</td>
<td>Tendinopathy (includes paratenonitis, tenosynovitis, tendinosis, tendinitis)</td>
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<tr>
<td>Bursa</td>
<td>Traumatic bursitis</td>
<td>Bursitis</td>
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<tr>
<td>Nerve</td>
<td>Neuropraxia, minor nerve injury/irritation</td>
<td>Entrapment, adverse neural tension</td>
</tr>
<tr>
<td>Skin</td>
<td>Laceration, abrasion, puncture wound</td>
<td>Blister, callus</td>
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## Conditions masquerading as Sports Injuries

<table>
<thead>
<tr>
<th>Bone and soft tissue trauma</th>
<th>Vascular</th>
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</thead>
<tbody>
<tr>
<td>Osteosarcoma</td>
<td>Venous thrombosis (e.g. deep vein thrombosis (DVT), axillary vein thrombosis)</td>
</tr>
<tr>
<td>Synovial sarcoma</td>
<td>Artery entrapment (e.g. popliteal artery entrapment)</td>
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<tr>
<td>Synovial chondromatosis</td>
<td>Peripheral vascular disease (PVD)</td>
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<tr>
<td>Pigmented villonodular synovitis</td>
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<tr>
<td>Rhabdomyosarcoma</td>
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<tr>
<td>Osteoid osteoma</td>
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<td>Ganglion cyst</td>
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<thead>
<tr>
<th>Rheumatological</th>
<th>Genetic</th>
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<tr>
<td>Inflammatory monoarthritis</td>
<td>Marfan’s syndrome</td>
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<tr>
<td>Inflammatory polyarthritis</td>
<td>Haemochromatosis</td>
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<tr>
<td>Inflammatory LBP (e.g. sacroilitis)</td>
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<tr>
<td>Enthesopathies (e.g. psoriatic, reactive arthritis etc.)</td>
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<thead>
<tr>
<th>Disorders of muscle</th>
<th>Granulomatous diseases</th>
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<tbody>
<tr>
<td>Dermatomyositis</td>
<td>Tuberculosis</td>
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<tr>
<td>Polymyositis</td>
<td>Sarcoidosis</td>
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<tr>
<td>Muscular dystrophy</td>
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*Brukner & Khan, 2001*
# Conditions masquerading as Sports Injuries

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<tr>
<th>Endocrine</th>
<th>Infection</th>
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<tbody>
<tr>
<td>Dysthyroidism</td>
<td>Osteomyelitis</td>
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<tr>
<td>Hypercalcaemia</td>
<td>Septic arthritis</td>
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<tr>
<td>Hypocalcaemia</td>
<td>Shingles</td>
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<td>Hyperparathyroidism</td>
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<td>Diabetes</td>
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<tr>
<td>Cushing’s syndrome</td>
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<td>Acromegaly</td>
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<th>Regional pain syndromes</th>
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<tr>
<td>Complex regional pain syndrome/reflex sympathetic dystrophy</td>
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<tr>
<td>Fibromyalgia/myofascial pain syndrome</td>
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</tbody>
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*Brukner & Khan, 2001*
“Occasional exercise is sometimes fatal, often injurious, and almost always painful”

Williams JPR 1974 Wales and British Lions fullback
Concussion

• Best described as the shaking of the brain leading to a brief loss of consciousness
  – Direct force such as a blow to the head
  – Indirect force as with whiplash in a car accident

• Recognition
  – Brief loss of consciousness, possibly delayed
  – Dizziness & mild headache
  – Nausea
  – Loss of memory
  – Disturbed vision
  – Pale, cold, clammy skin

• Seek medical assistance

• Do not allow the casualty to drive or play sport until seen by a doctor

Sevett 2006
Bleeding

• Open and closed wounds
  – Incised; a cut from a sharp edge
  – Laceration; rough tear or crush to the skin
  – Abrasion; graze or superficial wound from a rough surface
  – Contusion; bruise or internal bleeding
  – Puncture; an object entering the body
  – Velocity injury; a puncture wound at velocity will cause extensive damage, there may be an entry and exit wound

Sevett 2006
Types of bleeding

- **Arterial:**
  - Bright red; pumping, will lead to shock, unconsciousness and death within minutes

- **Venous:**
  - Dark red; gushing or pooling at the site of the wound, depends on size of the vein

- **Capillary:**
  - Oozing at the site as with an abrasion or perhaps internally from a contusion to muscle or internal organ

- When a blood vessel is torn or severed, blood loss and shock will cause the blood pressure to fall and the injured vessel will contract

- **At all times prevent cross infection**

Sevett 2006
Fracture

- **Fracture**: a break or rupture in a bone
- A deformity that can be seen or felt
- Pain on stressing the limb
- Abnormal movement in a limb due to movement at fracture site
- Crepitus or grating between bone ends
- Impaired function
- Swelling and tenderness at the fracture site
Deformity and Abnormal movement
Causes of fractures

- **Direct trauma**
  - external forces which exceed the strength of the bone.
  - direct violence e.g. RTA, a blow

- **Indirect trauma**
  - twisting or rotational forces being applied to the bone
  - e.g. football studs planted, rotation force applied to the limb resulting in spiral # of the tibia

- **There is always some element of soft tissue damage with a fracture**
  - Muscle
  - Ligaments
  - Neurovascular structures

McRae 1994
Causes of fractures

• **Pathological fracture** (A)
  – bone is already weakened or diseased
  – fracture because bone internal structure is weakened

• **Stress fracture**
  – Caused by repeated excessive loading of a bone, cumulated forces result in fracture

• **Avulsion fracture** (B)
  – Sudden muscle pull “pulls off” a small piece of bone, e.g. Peroneus Brevis muscle at the base of 5th metatarsal
  – High forces across a joint,
    • ligament is pulled from its insertion with a piece of bone.
  – Avulsion fractures may be associated with subluxation or dislocation of the joint

McRae 1994
Classification of Fractures

• Skin damage
  – Open fracture (compound fracture dated term)
    • skin broken
    • external source
    • internal source (compound from within)
  – Closed fracture (simple fracture)

McRae 1994
Fig. 7.8  Open and closed fractures: (a) closed fracture; (b) ‘compound from within’; (c) an open fracture with contamination.
Fracture Treatment and Management

- Restore the patient to optimal functional state
- Prevent fracture and soft-tissue complications
- Get the fracture to heal, and in a position which will produce optimal functional recovery
- Rehabilitate the patient as early as possible

- **Reduction** of the fracture
- **Immobilisation** of the fracture fragments
- **Rehabilitation** of the soft tissues and joints

McRae 1994; Brukner and Khan 2001; Milanese 2004
Fracture Management

- Priorities of Treatment
  - Treat life threatening injuries first
  - If fracture only injury … treat fracture

- Primary aim
  - Attain sound bony union
  - Full restoration of function

McRae 1994; Sevett 2006
Specific Traumatic Event
Joint Injuries

- High energy impact
- Traumatic knee injuries
- Damage to:
  - Menisci
  - Ligaments
  - Joint capsule
  - Bony structures
- Knee “big three”
  - Anterior cruciate ligament (ACL), medial meniscus, medial collateral ligament (MCL)

Pitmann and Frankel 1995; Clark 2003
Joint Injuries

- Shoulder
- Subluxation: an incomplete or partial dislocation
- Dislocation
- Associated damage to soft tissues in and around the joint
  - e.g. Rotator Cuff Tear
  - Stinger
- Acromioclavicular Joint (AC joint)

Brukner and Khan 2001
What are the Soft Tissues?

- Muscles & Tendons
- Ligaments and Joint Capsules
- Cartilage
- Nervous Tissue
- Connective Tissue
  - adipose tissue
  - dense connective tissue (tendons and ligaments)
  - elastic connective tissue

Brukner and Khan 2001; Clark 2004; Prentice 2004
Types of soft tissue injuries

- **TRAUMATIC:**
  - Specific cause is identified
  - Cause of injury easily identified

- **OVERUSE:**
  - Develop slowly cannot be attributed to one incident
  - Specific injuries associated with a particular sport

Evans 1994
Overuse Injury
Overuse Injuries

- Swimmers 10yr age
- 4 session per week (minimum)
- 1 session = 3000m
- 120 lengths per session
- estimated elite swimmers

1.2 - 2 million swimming strokes per year

Brukner and Khan 2001
Causes of Soft Tissue Injuries

• Intrinsic causes of injury
  – factors within the sports person

• Extrinsic causes of injury
  – factors outside the sports person
How the mighty have fallen

Tom Humphries in Sacramento

Somehow this process worked to his advantage, and he now looks like some kind of a serious competitor. But after the long eight weeks of competition, Michael Johnson and Maurice Greene are not expected to be out of the way. A shocking move against the greats, out of the way, aren't they?
Intrinsic Causes of STI

- Lack of warm-up.
- Inadequate fitness or physical weakness.
- Anatomical factors.
- Tight muscle groups
- Muscle imbalance
- Previous injury.

Clark 2004
Extrinsic Causes of STI

- Faulty technique.
- Inappropriate training: training errors; mode; duration; intensity
- Inappropriate clothing.
- Inappropriate footwear.
- Lack of protective safety equipment.
- Inappropriate environment.

Clark 2004
Some soft tissue injuries are easier to diagnose than others
Types of injuries

- **MUSCLE**: haematoma, strains, tears,
- **LIGAMENT**: partial tear, complete rupture
- **TENDON**: tendinitis, tendonosis, tenosynovitis.
- **BURSAE**: acute, chronic
- **SKIN**: abrasions, blisters, lacerations

Brukner and Khan 2001
SHE WAS JUST GOING FOR A SHORT RIDE.

A sweatshirt and jeans didn’t protect Brittany when she fell off a motorcycle and tumbled 500 feet down the highway. (And she was the passenger.)

SAVE YOUR SKIN.

Ask your dealer about the latest styles in protective gear.
Intermuscular haematoma.
Damaged fibres and broken blood vessels have leaked blood into surrounding tissues.

Intramuscular Haematoma
Caused by blow from another player
Effects of Heat and Cold

- Normal body temperature 36.9°
- Affected by extremes of heat or cold, dehydration, head, or spinal injury
- Heat is gained by conversion of food into energy, from external heat sources and by muscle activity

Sevett 2006
Effects of Heat and Cold

- Hot conditions cause blood vessels to dilate (vasodilatation) allowing excess heat to be lost through sweating and increased the breathing rate.
- Cold conditions cause blood vessels contract (vasoconstriction) reducing sweating.
  - Blood vessels in the skin shut down, stopping internal or core heat escaping.
  - Prolonged exposure to cold, wet, and windy conditions the core temperature may drop below 35°C, normal bodily functions slow and eventually stop.
  - This is *Hypothermia*.

Sevett 2006
Hypothermia

• Recognition
  – Shivering at first but will stop as condition progresses, usually when body temperature is between 29° and 34°
  – Cold, pale, and dry skin
  – Slow shallow breathing
  – Slow weak pulse
  – Strange irrational behaviour
  – Lethargy
  – Unconsciousness leading to coma and cardiac arrest

Sevett 2006
Dehydration

- Dehydration or Heat exhaustion
- Body temperature exceeds atmospheric temperature, particularly in humid conditions
- Often takes place with strenuous exercise
- Causes the loss salt and water
- Reduced fluid component of the blood, can lead to shock
  - Recognition
    - Headache
    - Confusion
    - Sweating with pale clammy skin
    - Muscle cramps in the abdomen and limbs
    - Rapid weakening pulse
    - Temperature around 39°

Sevett 2006
Hyperthermia

- Body temperature exceeds 40°
- Uncontrolled heat exhaustion, prolonged exposure to high temperatures or as a result of illness or fever
- This is known as *Heatstroke*

Sevett 2006
Heatstroke

- **Recognition**
  - Headache
  - Confusion and general discomfort
  - Hot, flushed, and dry skin
  - Body temperature of 40° + (the brain starts to swell)
  - Rapid deterioration
  - Full, bounding pulse
  - Slow, noisy breathing
  - Response levels deteriorate rapidly

- **Serious condition that can deteriorate rapidly so urgent medical attention is required**

Sevett 2006
Preventive Measures

- Healthy balanced diet
- Adequate hydration
- Basic physical fitness
- Correct technique
- Obey the rules of the sport
- Understand the requirements/demands of your sport

Peterson and Renström, 1986
Preventive Measures

• Adequate warm-up including stretching
• Preparation for sport and prevent injury
  – At rest the blood flow to the muscles is relatively low, approximately 15-20%
  – Activity progressively opens the blood vessels, after 15-20 minutes this flow increases to around 70-75%
• Progressive warm-up leads to a marked decrease in risk of injury and an enhanced performance

Peterson and Renström, 1986
Preventive Measures

• Cool-down
  – e.g. gentle jogging
  – Stretching

• Protective equipment

• Appropriate clothing

• Appropriate and functional equipment required for the sport

Peterson and Renström, 1986
Preventive Measures

- Correct training
- Effects on the musculoskeletal system
  - Skeleton
  - Cartilage
  - Connective tissue
  - Muscles
    - Isometric
    - Concentric
- Mobility and flexibility

Pollock et al 1998; Milanese 2004; Prentice 2004
**Effects on the Musculoskeletal System**

- **Wolff’s law** states the bone remodels according to the forces imposed upon it. Increasing the force transmitted through bone causes increased density and strength. Site specific e.g. Neck of Femur – controlled force must be imposed on that bone or the muscles that cross it.

- **Davis’ law.** Inert tissue (e.g. ligament) remodels along the lines of mechanical stress placed upon it – better quality and tensile strength due to appropriate orientation and organisation of collagen fibres.

- **Sensorimotor control.** “The control of both movement and posture”. Joint stability refers to the ability of a joint to maintain alignment and resist displacement, sensorimotor control of joint stability refers to the co-ordination of different muscle groups to control movement and posture.

- **Specificity of muscle training.** Muscle performance is highly specific to the type of training performed. Research demonstrates that the effects of exercise are mode specific – Open Kinetic Chain v Closed Kinetic Chain, muscle groups, ROM, muscle action, intensity, and velocity.
Preventive Measures

- Co-ordination and proprioception
- Sports specific training
- Weight training
  - Drawn up individually with regard to the subjects' age, sex, build, physical fitness, and sport
  - Great caution is advised when strength training programmes are prepared for the growing young person

Pollock et al 1998; Ashe and Khan 2004
References


References


References

