Skiing Injuries: Lower Extremity

Background
Upper Extremity
Nordic Skiing
Snowboarding

Epidemiology
1. Decline in tibial fractures, foot, ankle injuries by 87%
   - Due to new bindings/boots
2. Children more susceptible to tibial fractures

Prevention
1. Self test bindings each day
   - Step into binding
     - Twist to the side to release toe-piece
     - Lean forward to release heel-piece
   - If bindings do not release, professional adjustment necessary
2. Good ski instruction
   - Advance from novice level early

Knee Injuries
1. Epidemiology
   - 20-36% of all injuries
   - ACL injury
     - Most common
   - Women more often than men but less severe
     - Due to lighter weight
     - More susceptible to equipment related injuries
       - Strong springs or release capabilities not set for female skill, weight, and age
     - Extrinsic factors
       - Conditioning
     - Intrinsic factors
       - Joint laxity
   - Increase in Grade III tears from equipment causing force to be taken by knees instead of lower legs
     - Bindings are adjusted to prevent tibial fractures not knee sprains
     - Release too slow to protect the knee
2. Mechanism of injury
   - Valgus-external rotation
     - Catching inside edge and falling forward between skis
   - Boot induced
     - Land on back of ski with extended knee causing boot to force tibia forward as ski hits ground
   - Phantom foot phenomenon
     - Catching inside edge while falling backward between skis driving lower leg into internal rotation
o Usually no compression component like direct blow, deceleration, or change of direction
  ▪ Leads to less secondary trauma-meniscal tears, MCL injuries, bony contusions

3. Symptoms
o Immediate pain and/or instability
o Pain increases over next 24 hours
o Joint effusion
o Movement improves with resolution of swelling

4. Physical findings
o Positive Lachman’s test

5. Imaging
  ▪ AP/lateral/tunnel views of knee

6. Treatment
o RICE and crutches until swelling subsides
o Surgery depends on desired activity level
  ▪ Need for rotation, hyperextension movements

7. Prevention
o Teaching programs that help people avoid high risk behavior
o ID positions and maneuvers that may result in injury
o Responding appropriately in high risk situation may be beneficial for ski instructors
o No change in equipment seems to prevent injury

**Tibial Plateau Fractures**

1. Epidemiology
  ▪ Schatzker I
    ▪ Lateral plateau split fracture
  ▪ Schatzker II
    ▪ Lateral split/depression fracture
  ▪ Schatzker III
    ▪ Lateral plateau depression
  ▪ Schatzker IV
    ▪ Medial plateau split fracture
  ▪ Schatzker V
    ▪ Bicondylar plateau fracture
  ▪ Schatzker VI
    ▪ Fracture with metaphyseal – diaphyseal separation
  ▪ Schatzker I, II, III common
    ▪ IV, V less common but increasing

2. Mechanism of injury
o Increased forces transmitted to knee from equipment injuries
o Anterior half of joint with or without disruption of MC most common site
o Mechanism of injury
  ▪ Valgus load leading to compression on lateral compartment

3. Symptoms
o Immediate pain and swelling
o May be intra-articular swelling from intra-articular fracture and subsequent hemorrhage into joint
4. Physical exam findings
   o Do thorough neurovascular exam
     • Superficial Peroneal
       • Sensation over dorsal foot, foot eversion
     • Deep Peroneal
       • Sensation at dorsal web of digits 1,2, big toe dorsiflexion
     • Posterior tibial
       • Sensation over back of leg, bottom of foot, foot plantar flexion, big toe plantar flexion
   o Imaging
     • AP and lateral of knee
5. Treatment
   o May perform arthrocentesis for joint effusion if necessary
     • Sterile technique to avoid infection
   o Schatzker I-III
     • Arthroscopic surgery
     • If non-displaced:
       • Cast with ROM at 6 weeks
       • Weight bearing at 3 months
   o Schatzker IV
     • Hybrid external fixator or ORIF
   o Schatzker V, VI
     • ORIF

Head and Spine Injuries
1. Epidemiology:
   o 7% of all injuries
   o Incidence increasing due to increased acrobatics and high speed activities
   o No change with equipment changes
   o Head injuries
     • Most common cause of death in ski injuries is traumatic brain injury
       • 50-88% of all deaths in skiing/snowboarding
     • Males
       • 2.2 times more than females and those under 35
       • 3 times more common than older people
     • Concussions most common head injury
       • 11% of all ski injuries and 83% of head injuries
   o Spine injuries
     • 2-4% of all ski and snowboard injuries
     • Permanent neurologic sequelae or death 1 in 995,322
2. Mechanism of injury
   o Simple fall-most common
   o Fall with blow by ski or ski pole
   o Collision
     • Immovable objects (most fatalities)
     • Other people
     • Blunt trauma from chair lifts and T-bars
   o Head injuries-increased risk with
     • Fatigue
3. Physical findings and treatment
   ○ See trauma: Head, Neck, Back

4. Prevention
   ○ Helmets associated with 22-60% decrease in head injury (SOR C) ²
     ▪ Benefits of helmet use outweigh any possible risk of neck trauma in children due to lack of neck strength
   ○ Development of terrain parks
   ○ Focus on proper technique during acrobatic and snowboarding type moves
   ○ Strategies proposed
     ▪ Limiting uphill lift capacities
     ▪ Grooming snow to avoid high speed cruising
     ▪ Careful marking of all obstacles
     ▪ Heightened safety measures for children on ski slope and chair lift
     ▪ Minimize angle of approach for merging trails and runs

Pediatric Injuries

1. Epidemiology
   ○ 23% of all ski injuries but only 12% of all skiers
   ○ Risk factors
     ▪ Deficient binding adjustment
     ▪ Low skill level
     ▪ Use of rented equipment
     ▪ Excessive fatigue
     ▪ 15% associated with musculoskeletal immaturity

2. Mechanism of injury
   ○ Falls and collisions responsible for most trauma
     ▪ Excessive speed
     ▪ Adverse slope conditions
     ▪ Overconfidence
     ▪ Behavioral patterns within and among gender

3. Injuries
   ○ Head and neck
     ▪ 11-20% of all injuries
     ▪ Cranial trauma 67% of all fatalities
   ○ Upper extremity injury
     ▪ 22-79% of all injuries
     ▪ AC dislocation, clavicle, humeral fractures
   ○ Lower extremity
     ▪ 47.7% of all injuries
       ▪ Knee sprains and ACL tears
       ▪ Tibial fractures higher in this age group

4. Prevention
   ○ Formal instruction focusing on collision avoidance
   ○ Helmet use
   ○ Fall training
   ○ Avoid behaviors that lead to excessive risk
Binding adjustments
- Slope management
  - Overcrowding, trail and obstacle maker upkeep
- Minimize opportunity for excessive speed

References

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