Management of Multi-ligament Knee Sports Injuries

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Objectives

- Background
- On field assessment and recognition
- Treatment

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Definitions

- Multiligament knee injury: tear of at least 2 of the 4 major knee ligament structures:
  - Anterior cruciate ligament (ACL)
  - Posterior cruciate ligament (PCL)
  - Posteromedial corner (PMC)
  - Posterolateral corner (PLC)
- Knee Dislocation: Tear of 3 of the four major knee ligament structures.

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Incidence

- True incidence is unknown
- Review of 837 knee dislocations admitted 14 year period in Finland
  - Males, 18-29 years old - incidence: 29/1 million person-years in 2011
  - Incidence decreased by age
  - Women: Incidence similar in all age groups
- 107 cases (13%) required immediate open (69 cases) or closed (38 cases) reduction
- 1.6% incidence of popliteal artery injury requiring acute surgical
- Above knee amputation in one patient (0.1%)
  - Sillanpaa et al. *J Trauma Acute Care Surg.* 2014

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Incidence

106 multiligamentous knee injuries over 9-year period

- Incidence confirmed by MRI includes:
  - Anterior cruciate ligament (ACL) – 90%
  - Posterior cruciate ligament (PCL) – 79%
  - Posterolateral corner (PLC) – 78%
  - Medial collateral ligament – 28%
  - Peroneal nerve with motor deficit – 25%
  - Popliteal artery injury – 21%

- Becker et al. *J Orthop Trauma* 2013

- Most common combination
  - ACL/MCL 70.5%
    - Kaeding et al *Arthroscopy* 2005

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Mechanisms of Injury

- High energy mechanism, violent trauma more common versus low energy mechanism
- Cohort of 85 patients
  - 81% high-energy injuries
  - 47% sports-related injuries
    - Engebretson et al. *Knee Surg Sports Traumatol Arthrosc* 2009.
- Equivalent rates in additional studies
  - High energy: 50.3%
  - Low energy: 49.7%
    - Moatshe et al. *The Orthopaedic Journal of Sports Medicine* 2017.

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Mechanisms of Injury

1. Anterior Dislocation –Hyperextension
   a) 30° - posterior capsule
   b) 50° – ACL/PCL/Popliteal artery
2. Posterior- knee flexed 90°
3. Medial and lateral - rotatory

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Classifications

- 1994 - Schenck developed the most widely used classification system for dislocated knee

Type	Description
KD I	Knee dislocation with either cruciate intact
KD II	Bicruciate injury with collaterals intact
KD III	Bicruciate injury, one collateral ligament injury KDIIM – bicruciate with medial collateral ligament injury KDIIL – bicruciate with lateral collateral ligament injury
KD IV	Bicruciate injury with both collateral ligament injury
KD V	Periarticular fracture dislocation
Associated injuries – C=Arterial injury, N = Neural Injury	

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Patterns of Multi-ligamentous Knee Injury

Injury Pattern	No. Knees (n=82)	Percentage
ACL-PCL-PLC	35	43
ACL-PLC	14	17
ACL-PCL-MCL	14	17
PCL-PLC	6	7
ACL-PCL-PLC-MCL	4	5
ACL-PCL	4	5
ACL-MCL-PLC	3	4
PCL-MCL-PLC	2	2

Becker E, et al *J Orthop Trauma*. 2013.

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Assessment

- On-the-field assessment
  - Accurate and rapid evaluation of the injury
  - Address unstable fractures or dislocations
  - Safely transfer the athlete to the sidelines/hospital

Image Credit: Deadspin.com

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Assessment- History

- Focused History
  - Brief, but thorough- rule out fracture, dislocation, NV injury
  - Mechanism
    - Contact vs Non Contact
    - Position of the knee and lower extremity
  - Athlete's description of injury related sensations
    - Tearing
    - Pop
    - Patellar sliding
    - Subluxation
  - Previous injury

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Assessment- Physical Examination

- Rapid, Complete, Systematic - "Point to the area that is painful"
  - Observation- deformity, lacerations, skin dimpling, swelling, ecchymosis
  - Palpation- bony and soft tissue structures (tenderness, crepitation, step-offs)
  - Hemarthrosis and ROM to tolerance
  - Compartment examination
  - Complete Neurovascular Examination-
    - Check of gross sensation all cases, pay close attention to peroneal nerve with knee dislocations (ankle dorsiflexion)
    - Palpation of pedal and posterior tibial pulses

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Signs and Conditions

Signs	Conditions
Hemarthrosis, Deformity, Periarticular Lacerations	Fracture
Abnormal Pulses, Joint Deformity, Neurologic Deficits	Knee dislocation
Joint Deformity, Pain	Patellar dislocation

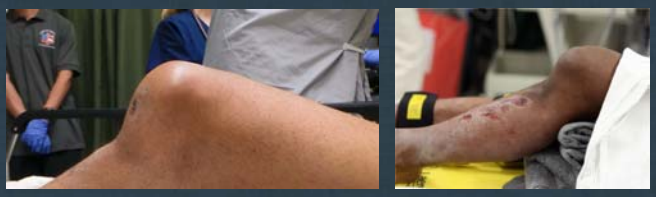

Image Credit: Western Journal of Emergency Medicine

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Move Athlete From Field For Further Exam

- Sometimes Reduction of limb with recheck of NV status
- Stabilization of limb
- Transfer to Level 1 ER – (Ortho and Vascular surgeons) as appropriate
  - Knee dislocation is a true orthopaedic emergency.
    - Popliteal Artery: 3-18% incidence rate
    - Can be limb threatening
    - Compartment syndrome common with arterial injury
      - Sanders et al. *J Bone Joint Surg Am.* 2017

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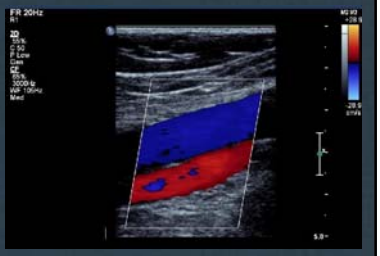
Diagnostic Modalities

- Radiographs obtained initially to evaluate for fracture
- MRI and/or CT scan for musculoskeletal evaluation
- ABI, Ultrasonography, Angiography, MR Angiography, CT Angiography
  - Evaluating for concomitant injuries:
    - Popliteal Artery: 3-18% incidence
      - Sanders et al. *J Bone Joint Surg Am.* 2017
    - Peroneal Nerve: 25% incidence
      - Medina et al. *Clin Orthop Relat Res.* 2014.
    - Meniscal and focal cartilage injuries – 37.3% incidence
      - Moatshe et al. *J ISAKOS* 2017.



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Surgical Intervention

- Acuity and pattern of injury
- Physical examination under anesthesia and arthroscopic evaluation
- Flexible operative plan
- Vascular surgery should be on backup
- Better outcomes reported with acute treatment
  - Levy et al. Arthroscopy 2009
  - Single stage reconstruction of all injured ligaments within 3 weeks after the injury preferred
    - Buyukdogan et al. *Arthroscopy Techniques.* 2017
  - Staging the reconstruction can potentially alter joint kinematics, and increase the risk of graft failure

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Post Operative Rehabilitation

- Typically 9-18 months of rehabilitation
- Focus on graft protection and functional outcomes
- Early mobility associated with better outcomes
- Respect the structure addressed during surgery with the slowest time course for healing or greatest probability of failure
- Timeframe for immobilization, progression of rehabilitation and return to sport is dependent on structures involved

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Case #1

- 19 y.o. male baseball player with hyperextension injury
- Exam: pain at LCL, fibular head medial femoral condyle and biceps femoris; (+) Lachman's, Anterior Drawer, Varus Stress
- MRI: Posterolateral corner disruption (ACL, biceps femoris, FCL), femoral contusions, no meniscal pathology
- Left knee ACL reconstruction with BTB autograft, LCL reconstruction with allograft, biceps femoris repair and peroneal nerve neurolysis DOS: 4/5/2018

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Case #2

- 40 y.o. male, golf cart rollover accident
  - Multi-trauma with a valgus mechanism
- Exam: Joint line tenderness (medial and lateral), (+) Patellar Apprehension, Valgus
- MRI: complete tear of ACL, PCL, MCL complex, bucket-handle tear of lateral meniscus, medial meniscus tear, lateral tibial plateau fracture
- 2 staged procedure recommended

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Case #2

- Right knee arthroscopy with lateral meniscal repair 8/29/17
- Right knee ACL reconstruction with hamstring autograft, PCL reconstruction with Achilles allograft, MCL reconstruction with anterior tibialis allograft of 10/5/17

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Thank You!

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