Sports medicine course for nurses

Meniscus & Cartilage injury of knee

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Meniscus anatomy

- **Fibrocartilagenous** structure
- Located between femoral condyle & tibial plateau
- Crescents shape
- Triangular cross section
- Cover 1/2 – 2/3 tibia plateau articular surface
Meniscus anatomy

- **Medial meniscus**
  - C shape
  - Attached to medial capsular structure, deep MCL
  - Tear more common in chronic ACL deficient knee
    - Secondary restrain of anterior tibia translation

- **Lateral meniscus**
  - Circular shape
  - Attachment: coronary ligament / menisco-femoral ligament
  - **More mobile** than medial meniscus
  - Tear more common in acute ACL tear
    - Anterolateral translation during ACL injury
Meniscus function

- **Shock absorption**
  - Increase surface area of contact → decrease contact stress

- **Complete menisectomy**
  - Decrease contact area by 40 – 75%
  - Increase contact stress by 136 – 236%
- **Major fiber orientation** *circumferential*
  - Resist compressive loading
  - By creating hoop stress

- **Mid substance fibers** *radial* orientation
  - Resist *longitudinal* split

- **Surface fibers** *woven* pattern
  - Resist *sheer* stress
Meniscus function

- Joint stability
- Joint lubrication
- Proprioception
Blood supply

- Medial & lateral genicular arteries
- Vessels form perimeniscal capillary plexus within synovial & capsular tissue of knee joint
- Supply peripheral 1/3 of meniscus
  - ie medial 2/3 of meniscus → relative avascular
  - Red – Red zone
  - Red – white zone / White – White zone
  - Different healing potential
Meniscus tear

- History
  - Rotation as the flexed knee moves toward an extended position
  - Less mobile medial meniscus trap between the femoral condyle and tibial plateau → tear
Meniscus tear symptoms

- **Effusion**
- **Pain**
- **Locking**
  - Inability to extend knee

- **Chronic case**
  - Clicks, catches, snaps as knee moves
Physical exam

- Effusion
- Local tenderness over joint line
- Range of motion
  - Mechanical block
- McMurray test
Mcmuarry test

Medial meniscus
ER + Varus

Lateral meniscus
IR + Valgus
XR

- Not to confirm diagnosis of torn meniscus
- Exclude
  - Osteocartilaginous loose body
  - Osteochondritis dissecans
- That mimic torn meniscus
MRI

- Sensitivity 83%
- Specificity 84%
- Look for concomitant ligament, cartilage injuries
Treatment

- Nonoperative
- Operative
Non-operative

- Incomplete tear

- Small (5mm) stable peripheral tear with no other pathological condition eg ACL tear

- Treat non operatively with good results
Operative treatment

- Locked knee
  - Bucket handle tear

- Associated cruciate ligament injury

- Chronic tear with superimposed acute injury

- Fail conservative treatment
Operative choices

- Principle: Preserve as much as possible
- Meniscus repair
- Partial menisectomy
- Meniscus allograft
Meniscus repair

- Success rate higher
  - Red – Red zone
- Pattern of tear
- Chronicity
- Concomitant ACL reconstruction
  - biochemical / mechanical
Meniscus repair

- **Arthroscopic technique**

- **Medial meniscus**
  - Risk of saphenous nerve injury

- **Lateral meniscus**
  - Risk of peroneal nerve injury
Rehabilitation after meniscus repair

- Varies
  - Pattern of tear
    - longitudinal vs radial
  - Stability of repair
  - Surgeon preference
  - Patient demand
- Hinge brace 0-90d x 4-6 wks
- PWB x 4-6 wks
- Return to sports 4 – 6 months
Try to avoid total menisectomy

- Removal 1/3 of meniscus increase joint contact force by 40-70%
- Increasing degenerative changes in post total menisectomy knee
Partial menisectomy

- Symptomatic, fail conservative care
- Tear beyond salvage

- Allow faster rehabilitation
  - Immediate full weight bear
  - Immediate range of motion exercise
Conclusion

- Meniscal injury
- Common, may associate with ligament injury
- **Most can be treated conservatively**
- Except
  - Lock knee
  - Associate cruciate injury
  - Fail conservative treatment
- **Surgical treatment**
  - Meniscus repair
  - Partial menisectomy
Chondral lesion in a young patient

- What is cartilage?
- What is the patient’s problem?
- What should I do?
- What are the options? Challenge?
Articular cartilage

- Specialized connective tissue
- Biphasic material
  - Solid matrix
  - Water fluid phase
- Matrix
  - Water (70%), collagen, proteoglycan
- Chondrocyte
  - Production of matrix
- Avascular, no neural supply
- Nutrition
  - Diffusion from synovial fluid
Mechanical property

- Viscoelastic property allow tissue response to stress.
- Mechanical sponge which absorb tremendous compressive forces,
- Load distribution
- Low friction surface for motion
Response to injury → Poor

- Poor blood supply

- Few chondroblast → chondrocyte

- Full thickness tear → healed in fibrocartilage

- Suboptimal biomechanical property
Problem of poor healing

- Poor healing
- Persistent cartilage defect
- Abnormal load distribution

- Pain
- Early osteoarthritis, disability
What should I do?

- **Regenerate**
  - Fibrocartilage
  - Cartilage

- **Replace**
  - Joint replacement
    - UKA
    - TKR

SK-II 「神仙水」

每支含超過90% Pitera®的 SK-II 「神仙水」，能將 Pitera® 輸送至肌膚深層，從底層肌膚著手解決頑固的肌膚問題，
在約14天優生期內幫助肌膚孕育健康新細胞，尤如為肌膚打好底子。 同時有助提升肌膚的 新陳代謝效率，使
肌膚能夠維持約28天的理想更新週期，重拾晶瑩剔透的膚質。
- **Regenerate**
  - **Mechanical technique**
    - Arthroscopic lavage & debridement
  - **Marrow stimulation technique**
    - Subchondral drilling
    - Microfracture
  - **Resurfacing**
    - Osetochondral autograft
    - Autologous chondrocyte implantation

- **Resurfacing**
  - Joint replacement
Success in cartilage regeneration

- Must ensure knee
  - Stable
    - Treat concomitant ligament injury
  - Normal alignment
    - Correct deformity

- ...........before you go and tackle the cartilage defect
Arthroscopic lavage & debridement

- Removal of impinging osteophytes, inflammed synovium, loose chondral debris

- Removal of degradation enzymes, factors that cause pain

- Advantage: minimal invasive / simple surgery / easy rehab.

- Short term improvement observed, especially patient with clear mechanical symptoms

- No long term benefit
Marrow stimulation technique

- Creation of bleeding
  - → fibrin clot
  - → invade by undifferentiated cell
  - → chondrocyte like cell

- Synthesize matrix → collagen, proteoglycan
Drilling

- 0.062 K wire
- Holes 2-3mm apart
- Deep to cancellous bone
- Tourniquet released
- Bleeding

- Healing with fibrocartilage
- Problem: thermal necrosis
Microfracture

- Debridement of loose cartilage edge
- Removal of calcified layer
- Small holes by hand awl
- 4mm depth hole
- 3-4mm apart
- Formation of blood clot, rich in pluripotential marrow
- (release of tourniquet to confirm bleeding)

- Advantage: no thermal necrosis
Ideal candidate for microfracture

- Lesion < 2cm²
- Preoperative symptoms < 1 yr
- Age < 40 yrs

- Kreuz et al. Is microfracture of chondral defects in the knee associated with different results in patients aged 40 years or younger. Arthroscopy 2006
Post op rehabilitation

- CPM
  - Improve quality of repair tissue
    - Nutrition
    - Accelerate cellular differentiation of marrow mesenchymal cells into matrix producing fibrochondrocyte

- Early protected motion
- Touch down walking x 6 weeks
- Gradual strengthening exercise
- Return to sports
  - 4-6 months
Microfracture

- Regenerated tissue
  - Hybrid of hyaline cartilage & fibrocartilage

- Initial result deteriorate over time due to poor wear characteristics of repair tissue
Osteochondral autograft transplantation

- Cylindrical osteochondral pulgs from relative non weight bearing area of knee
- → insertion to articular defect
- Arthroscopic / Open surgery
Osteochondral autograft transplantation

- **Donor site**
  - Patellar groove
  - Area proximal to intercondylar notch
  - Superior medial margin of femoral notch

- **Difficulty**
  - Limited donor site
  - Only suitable for small defect ~ < 2.5 cm
  - Difficulty to re-create normal articular contour
Mosaicplasty - Advantages

- Hyaline cartilage
- Superior biomechanical properties

Mosaicplasty - Disadvantages

- Graft dislodgement
- Incongruent surface → OA of opposing surface
- Small grafts may break
- Failure of grafts to heal
- OA of donor sites if too many grafts and too large → limited size of treatable defect
Autologous Chondrocyte implantation

- 2 surgeries
  - 1st surgery
    - Normal host cartilage harvested → cell culture
  - 2nd surgery
    - Transplant the cells under a harvested periosteal patch through arthrotomy
  - Better wear characteristics of repair tissue than microfracture
**Advantage**
- Potential to restore normal hyaline cartilage

**Disadvantage**
- Highly technique dependent
- Require 2 stage procedure
- Laboratory support
- Expensive
Management of chondral lesion

- No perfect solution

- Each technique pros & cons
  - Simple – Complex
  - Size of defect
  - Donor morbidity
  - Cost
  - Patient demand
Thank You