Osteochondritis Dissecans of the knee

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Osteochondritis Dissecans

- OCD
- Condition of joints that affects subchondral bone
- Secondary Effects on articular cartilage
- With progression may disrupt the integrity of cartilage and bone
  - Cartilage flaps
  - Loose bodies
  - Inflammatory synovitis
  - Effusion
  - Secondary joint degeneration
Osteochondritis Dissecans Etiology

- Unclear
  - Repetitive Microtrauma
  - Vascular insufficiency
  - Genetic factors
  - Knee most commonly involved
    - Lateral aspect of medial femoral condyle
    - Ankle
      - Talus
      - Recurrent Ankle sprain
      - Persistent pain following sprain
    - Elbow
      - Capitellum
      - Throwing athlete
OCD Classification

- Location
- Fragmentation
- Displacement
- Growth plate status

- X-ray
- Bone Scan
- MRI
- Intraoperative
OCD - Typical Patient

- 10 to 15 years
- Male to female
  - 2:1
- Bilateral
  - 15-30%
  - Screening of contralateral side
OCD - Genetic Factors

- Questionable genetic predisposition
- OCD Associated with:
  - Dwarfism
  - Tibia vara
  - Legg-Calve-Perthes
  - Stickler syndrome
OCD - Vascular Factors

- Possible etiology
- No evidence of osteonecrosis
- Paucity of vascular supply
  - Medial femoral condyle near PCL insertion
- Reparative process arrested at fibrocartilage stage
  - Poor blood supply?
OCD - Traumatic Factors

- 40% Report history of trauma
- Shear forces on cartilage and subchondral bone
- Repetitive Microtrauma
- Difficult to distinguish between OCD and osteochondral fractures
  - Radiographic
  - Histological
OCD - Clinical Presentation

- Open Physes
  - Juvenile-onset OCD
- Closed Physes
  - Adult-onset OCD
  - Delayed onset of previously asymptomatic lesion
OCD - Clinical Presentation

- Pain
  - Generalized
  - Anterior
- Swelling
  - Intermittent
  - Activity related
- Mechanical symptoms
  - Catching
  - Locking
  - Giving way
OCD - Clinical Exam

- Inspection
- Palpation
  - Medial femoral condyle
  - Flexion
- Range of Motion
- Strength
- Ligamentous Stability
- Mensical testing
OCD - Physical Exam

- External rotation of tibia during gait
  - Avoid impingement of tibial eminence on OCD of medial femoral condyle
- Wilson’s test
  - Internal rotation of tibia between 30° and 90°
  - Reproduces pain
  - Relieved with external rotation
  - Poor predictive value
OCD - Radiographs

- AP and lateral
  - Weightbearing
- Sunrise
  - Patellar lesion suspected
- Notch view/Tunnel view
  - Knee bent 30° to 50°
  - Posterior condyle
OCD - Radiographic Features

- Open vs. Closed Physis
  - Closed poorer
- Location of Lesion
  - Atypical poorer
- Size of Lesion
  - Larger poorer
- Presence of Loose Bodies
- Sclerosis
  - Poor predictor of healing
- Potential dissection
OCD X-Ray Classification

- Cahill and Berg
  - 15 alphanumeric zones
    - 5 medial to lateral
    - 3 anterior to posterior
OCD Xray and Bone Scan Classification

- Cahill and Berg
  - Stage 0
    - Normal in both
  - Stage 1
    - Defect on plain radiograph
    - No uptake on bone scan
  - Stage 2
    - Increased uptake in lesion but not surrounding condyle
  - Stage 3
    - Increased uptake in lesion and condyle
OCD - Xray and Bone Scan

- May suggest healing potential
- Higher healing potential
  - Open physes
  - Uptake on bone scan
OCD - Xray Classification

- Berndt and Harty
  - Initially described talar lesions
  - Stage I
    - Small area of subchondral bone compression
  - Stage II
    - Partially detached fragment
  - Stage III
    - Completely detached fragment
    - Remains in crater
  - Stage IV
    - Complete detachment
    - Loose body
MRI Features of OCD

- Valuable for OCD assessment
- Fluid behind lesion
- Partial/Complete detachment
- Cartilage breech
  - Low signal intensity on rim
  - Fibrous tissue

- Instability criteria
  - Increased signal ≥5 mm diameter beneath lesion
  - Focal defect ≥5mm in articular surface
MRI - OCD

- MR Arthrogram
  - May aid in detecting instability
- Cartilage-specific sequence MRI
  - Distinguish between synovial fluid, fibrocartilage, and degenerated or lytic subchondral bone

Larsen et al
OCD - MRI Classification

- Dipaola et al
- Grade I
  - No break in articular cartilage
  - Thickening of articular cartilage
- Grade II
  - Articular cartilage breached
  - Low signal rim behind fragment
    - Fibrous attachment
- Grade III
  - Articular cartilage breached
  - High signal behind fragment
    - Fluid
- Grade IV
  - Loose body with defect of articular surface
The clinical utility and diagnostic performance of MRI for identification and classification of knee osteochondritis dissecans


• Systematic search
• Limited available evidence
• Supports use of MRI to detect stability or instability of lesion
OCD - Intraoperative Classification

- Guhl
- Cartilage integrity and stability
- Type I
  - Softening of cartilage
  - No breech of cartilage
- Type II
  - Breeched cartilage
  - Stable
- Type III
  - Definable fragment/Flap
  - Partially attached
- Type IV
  - Loose body
  - Osteochondral defect
OCD Intraoperative Assessment

- Size
- Number of loose fragments
- Bone associated with fragment
- Quality of underlying bone
OCD Prognosis

- No randomized, controlled clinical trials
- Predictors for surgical intervention
  - Physeal maturation
  - Dissection of lesion from subchondral bone
  - Size and location of lesion
  - Integrity of articular surface
OCD Prognosis

- Hefti et al 1999
  - Large multicenter review
  - 509 knees in 452 patients
    - No dissection better prognosis
    - Pain and swelling not indicative of dissection
    - Xray and CT do not predict dissection
    - Scleros has a poor response to drilling
    - Lesions ≥2 cm have worse prognosis
    - Surgery outcomes better than nonoperative in dissection
    - Lesions in classic location better prognosis
  - Adult onset
    - 42% abnormal radiographs after treatment
  - Juvenile onset
    - 22% abnormal radiographs after 3 years
OCD Treatment

- Nonsurgical
  - Promote healing
  - Prevent displacement
- Surgical
  - Repair native cartilage
  - Restoration procedures
OCD Nonsurgical Management

- Activity modification
- Crutches/Restricted weightbearing
  - Allow range of motion exercises
- Braces or casting
  - Noncompliant
- Symptom control
  - Acetaminophen
  - Theoretical negative influence of NSAIDs on bone healing
OCD Surgical treatment

- Drilling
  - Transchondral drilling
  - Retrograde drilling
- Repair
- Debridement/Excision
- Reconstructive Techniques
  - Evolving
Surgical management of juvenile osteochondritis dissecans of the knee


- 39 studies systematic review
- Significant improvements (nearly all)
  - Clinical
  - Radiographic
  - Short, mid, and long-term follow-up.
- Isolated excision of weight-bearing OCD
  - Poorer clinical and radiographic results
- Outcomes better with juvenile OCD versus adult OCD
Drilling

- Stable lesions failed conservative treatment
- Normal articular cartilage
- Stimulate vascular ingrowth for subchondral bone healing
- Anterograde technique
  - Transchondral drilling
- Retrograde technique
  - Fluoroscopic assisted to avoid penetrating articular cartilage
Functional and Radiographic Outcomes of Juvenile Osteochondritis Disseccans of the Knee Treated With Extra-Articular Retrograde Drilling


- 31 patients
- 4 year follow up
- Knee scores significantly improved
- Radiographs showed stable or improved lesions
- Avoid drilling through articular cartilage
Drilling Juvenile Osteochondritis Dissecan: Retro-or Transarticular?


- Systematic Review
- 65 studies
  - 12 met inclusion criteria
- No clear differences in patient oriented outcomes
- Radiographic healing
  - 86% retroarticular
  - 91% transarticular
- No complication reported for either
Surgical Repair

- Unstable lesions
- Fixation choices
  - K-wires, cannulated screws, Herbert (Headless) screws, bone pegs
  - Metal hardware requires removal
- Biodegradable implants
  - Pins/darts, screws
  - No need for removal
  - May cause reaction/synovitis
Case 1 OCD Repair

• History
  • 18 yo male with sudden pain and swelling after twisting knee playing football
  • Minor intermittent pain and swelling for preceding 6 months

• Exam
  • Large Effusion
  • Decreased Range of Motion
  • No obvious Ligamentous Instability
  • Medial tenderness
Case 1 X-rays
Case 1  _ MRI

- Unstable lesion
  - Cartilage disrupted laterally
- Fluid tracking
  - Laterally
  - Behind bone
Case 1 IntraOp

- Lesion identified
- Unstable anterior and lateral
  - Hinged
- Slight fragmentation
  - Anterior and posterior
- Proceed with open repair
Case 1 IntraOp

- Repaired with combination of Bioabsorbable headless screws and darts
Reconstruction

- Microfracture
- Osteochondral Autologous Transplantation (OATS)
- Autologous Chondrocyte Implantation
- Osteochondral allograft
- Articular Cartilage allograft
- Evolving
  - Biomimetic Osteochondral Scaffold
  - Bone Marrow Derived Cell Transplantation
  - Bone Cartilage Paste Graft
Microfracture

- Performed for area of articular cartilage defect
- Multiple penetration hole through to subchondral bone
- Stimulate healing response
- Fibrocartilage is formed
- Does not create new hyaline cartilage
- Most useful in small lesions
Osteochondral Autologous Transplantation (OATS)

- Non-articulating cartilage moved to defect area
- Harvested as plug of cartilage and subchondral bone
- Useful in medium sized lesions
  - <2 cm²
A Prospective, Randomized Clinical Study of Osteochondral Autologous Transplantation Versus Microfracture for the Treatment of Osteochondritis Dissecans in the Knee Joint in Children.


- 50 patients
  - 25 each group
- Both groups improved
- More patients in OAT group maintained good or excellent results.
- MRI showed good or excellent repairs in more OAT patients at 18 month follow up
Autologous Chondrocyte Implantation (ACI)

- Non-articulating cartilage is harvested
- Chondrocytes grown in lab
- Chondrocytes re-implanted
  - Patch sewn over defect
    - Periosteum
    - Commercially available membrane
  - Chondrocytes injected behind patch
Outcomes of Autologous Chondrocyte Implantation in Study of the Treatment of Articular Repair (STAR) Patients with Osteochondritis Dissecans


- Case Series
- 40 patients with one failed non-ACI treatment
- 32 patients completed 48 month followup
- 85% successful
  - Clinically and statistically significant improvements
    - Pain
    - Symptoms
    - Sports and recreation ability
    - Activities of daily living
    - Knee-related quality of life
  - 35% had subsequent surgical procedure
    - Debridement of lesion
Fresh Frozen Osteochondral Allograft

- Large plug from cadaveric femoral condyle implanted in defect
- Size matched
Can Fresh Osteochondral Allografts Restore Function in Juveniles With Osteochondritis Disssecans of the Knee?


- Retrospective Review
- 11 Children with OCD treated with fresh osteochondral allografting
- All returned to activities of daily living at 6 months
- All returned to full sports activities between 9 and 12 months
- Followup radiographs at 2 years showed full graft incorporation
Allograft Juvenile Cartilage

- Minced cadaveric cartilage tissue
  - Donors 2 years old and younger
  - Chondrocytes with Proliferation Potential

- Early promising results
  - May be equal or superior to ACI

- No independent studies
  - Company driven studies available
Case 2 Juvenile Cartilage Allograft

- 30 yo male
- Large 6 cm² osteochondral defect
- 6 month postop scope unrelated lateral pain
- Healed hyaline or hyaline like cartilage
How to Treat Osteochondritis Dissecans of the Knee: Surgical Techniques and New Trends


- 60 patients
- 5 techniques
  - OATS
  - ACI with bone graft
  - Biomimetic nanostructured osteochondral scaffold
  - Bone Cartilage Paste Graft
  - Bone Marrow derived Cell Transplantation Technique
- All achieved good clinical and radiographic results
- Trend towards better results with ACI
Additional Techniques

Surgical Techniques

A. Massive Autologous Osteochondral Transplantation

B. Bone-Cartilage Paste Graft

C. 2nd Generation Autologous Chondrocyte Implantation + Bone Graft

D. Biomimetic Osteochondral Scaffold

E. BMOC Transplantation
Osteochondritis Dissecans

Summary

- Etiology still not fully understood
- Preserving native cartilage and bone best (if possible)
  - Conservative
    - Stable lesions
  - Repair
    - Stable lesions that do not heal
    - Unstable lesions
- Reconstructive techniques have good results if repair not possible or if repair fails
Thank You!
References

References (cont)