

# The Knee: differential diagnosis & management strategies

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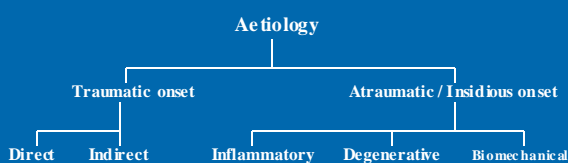
THE TIBIO-FEMORAL JOINT IS ONE OF THE  
MOST FREQUENTLY INJURED JOINTS  
IN HUMANS!!!

- Major weight bearing joint
- Withstands up to 5 times body weight during jumping & running
- Articular surfaces are incongruent allowing a high degree of movement
- Long lever arms expose the joint to large forces

The Patello-femoral joint  
withstands the highest joint  
compressive forces in the body  
– almost 8X body weight on a  
full squat - and has the thickest  
hyaline cartilage in the body  
(5mm on lat facet)

## Joint Stability

- Femoral condyles; Tibial plateaux; Menisci
- Active:  
Muscles – Quads; hamstrings; gastrocs;  
gracilis & sartorius; popliteus
- Passive:
  - ACL, PCL, MCL & LCL
  - Capsule (posteromedial & posterolateral)
  - Iliotibial tract



## The acute knee in primary care

Successful management of an acute knee injury  
often depends on the doctor of first contact.

*Roy S. The diagnosis and initial management of the acutely injured knee  
with particular reference to sport injuries. SAMJ 1975; 49(10):363-7.*

### Most common injured areas:

Ligaments 40%  
Misc. (contusions, bursitis etc) 29%  
Patella 24%  
Meniscus 11%

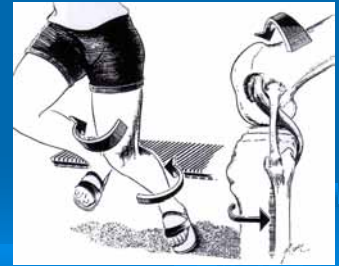
*Myasaka et al 1991*

## Diagnosis

- History
- Symptoms
- Clinical Examination

## Traumatic onset – History:

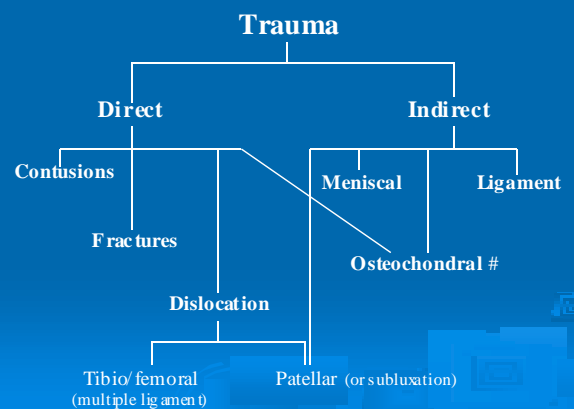
- Mechanism
- Direction of Forces
- Contact
- Noises
- Pain



## Gauge the severity of injury

### What happened next?

- got up & Continued
- continued then stopped ? GW
- hobbled off
- carried off
- Position of leg



## History taking

### Did the knee swell?

- Immediate or later?
- If yes was it mild or severe?

### Ecchymosis?

## Swelling

- Immediate (within minutes) → haemarthrosis



- Delayed effusion → internal derangement

- Ecchymosis → extracapsular
- Ecchymosis → capsular tear / PCL

## Haemarthrosis or Effusion?

Is it important to distinguish between the two at the primary care level?

71 - 72% of Haemarthroses = ACL injury.



K. Dehaven, 1980  
Bomberg & McGinty, 1990

## Primary assessment

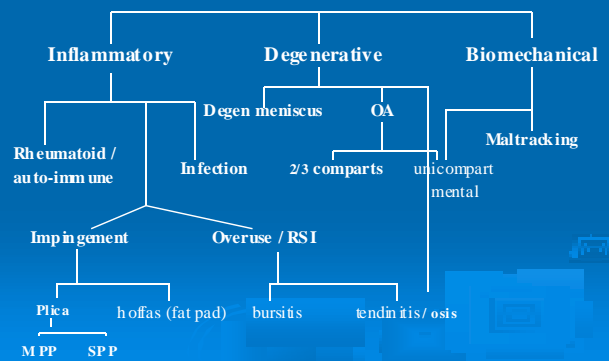
About 35% of ACL injuries are missed on initial diagnosis

*Mafulli et al. Acute haemarthrosis of the knee in athletes. JBJS 1993; 75(6):945-9*

## Insidious onset – History:

- Duration & course (ie. improving or deteriorating)
- Aggravating / alleviating factors
- Description of symptoms: pain; swelling; stability
- Previous injury / occurrences
- Age and level of activity?

## Spontaneous / insidious onset



## Symptoms

### Swelling?

Constant gross swelling with heat ? ? **infection**

Constant effusion ? inflammatory arthropathy  
mechanical

Recurrent / worse after activity ? impingement  
mechanical

Localised swelling ? extra-articular problem

### Pain

- Constant pain unrelated to activity – red flag
- Aching (night pain) – degeneration & OA
- Sharp or catching pain – mechanical problem
- Pain during activity – mechanical
- Pain after activity – inflammation (tendinitis, plica, bursa)
- Site and spread of pain – superficial (specific); deep (vague)
- How long for aggravated pain to settle

## Mechanical symptoms:

### Instability / locking / catching

- Ligaments – instability; clunking
- Meniscus – locking; catching; giving way
- Plica – pseudolocking; catching; giving way (reflex inhibition – commonly ? stairs)
- Fracture - instability
- Subluxation - instability

? Do symptoms occur on weight bearing; twisting or turning; after being in static position or on stairs / hills.

## Typical presentations

### Meniscus

- Flexion & twisting injury with sharp pain, deep but towards one side of the knee
- Effusion
- Restriction of movement – often both flex & ext (block to ext = displaced b/h tear)
- Tender joint line
- +ve McMurray's test
- Pain on compression (valgus/varus stress)
- Residual pain/ache deep in joint – often at the back of the joint

### Loose body

- Not always an injury episode – could be spontaneous onset
- Block to either flex or ext
- ? effusion

## ACL

- Injury episode – 'popping' sound
- Haemarthrosis
- ? Able to walk – instability
- +ve Lachman – soft end point ? total rupture
- ? +ve pivot shift test
- Pain deep inside joint. Often at back of knee if prox avulsion

## PCL

- Often hyperextension injury
- Ecchymosis – bruising & swelling in calf due to posterior capsule leakage
- +ve posterior drawer (beware false -ve)
- +ve sag test
- Often associated with LCL & P/L corner injuries? instability

## Clinical Tests:

### Ligaments

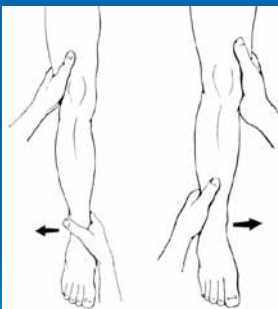
- Anterior drawer @ 90° ?
- Lachman's test @ 15°
- ? Lateral Pivot Shift
- Posterior Drawer @ 90°
- Valgus / varus stress in extension / 30° flexion

### Meniscal injury

- Joint line tenderness has fairly good sensitivity, but lacks good specificity
  - McMurray's test: Very specific but very low sensitivity
- Malanga GA, Andrus S, Nadler SF, McLean J. Physical examination of the knee: a review of the original test description and scientific validity of common orthopedic tests. Arch Phys Med & Rehab 2003; 84(4):592-603.*

ALWAYS COMPARE WITH OTHER SIDE

## Testing collateral ligaments



Test in full extension & at 20° flexion

## Lachman's test

- Very sensitive and specific for ACL

*Malanga GA, Andrus S, Nadler SF, McLean J. Physical examination of the knee: a review of the original test description and scientific validity of common orthopedic tests. Arch Phys Med & Rehab 2003; 84(4):592-603.*

- Low correlation with subjective instability

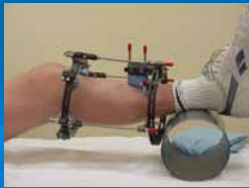


## Drawer & Sag tests

- Posterior sag
- Drawer test (90°)

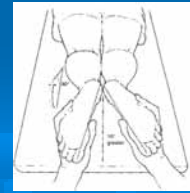
**Both very sensitive & specific for PCL**

*Malanga GA, et al; Arch Phys Med & Rehab 2003; 84(4).*



## Specific tests for PL instability

- Instability to varus stress in extension
- Instability to varus stress in flexion only
- Reverse Lachmann test (i.e. posterior/PL instability at 20°)
- The hyperextension rotation test
- The dial test



## What is urgent?

- Fracture ? urgent A & E
- Knee dislocation (tibio-femoral)– multiple ligament injury: urgent hospitalisation to check vascular damage
- Ligament / tendon repair: urgent surgery (within a few days)
- Bucket handle tear - locked knee: urgent surgery (within a few days)
- Meniscal repair: better early
- Meniscus : Partial menisectomy: no n-urgent
- Intra-articular Ligament reconstruction - not urgent optimum time 4 weeks

## P.R.I.C.E

P protection

R rest

I ice

C compression

E elevation



## Weight Bearing

Criteria for limiting weight bearing - PAIN

- NWB - inability to weight bear
- PWB - Discomfort on weight bearing
- Effusion
- Minor / moderate instability



## Rest

Decreased activity  
NOT  
inactivity

- Protects the injury
- Allows normal healing to take place

### Inactivity

Delayed healing

- Adhesions
- Muscle atrophy
- Reduced proprioception

### Too Active

Stress to injured structures

- Increased inflammatory response
- Reduced neurological status

## SUMMARY suggested protocol for the knee

- 1kg pack of crushed ice in a plastic bag
- Elevate limb 15 - 25cms above level of heart
- Leave for 15mins → remove ice but maintain elevation
- Continue to compress throughout
- Reapply ice every 2 hours

## Acute Injuries (3-5 days) During PRICE regime

- PWB until swelling ↓
- Isometric quads
- Painfree ROM exercises – may need to work on full extension



### Weeks 1 – 3

- Regain full ROM (flex & ext)
- Graduated strengthening & proprioception

NB- If meniscal avoid rotation & loaded full flexion,  
If cruciate avoid appropriate open chain exercises



## Conservative Management (2):

### Weeks 3-12 as applicable:

- Gradually ↑ activities to include more load bearing
- Introduce resisted open chain as appropriate
- Functional activities to include
  - acceleration/deceleration
  - changing direction – cutting movements
  - sports specific activities



## The Collateral ligaments

### Mechanism of injury

- Direct valgus or varus stress with or without rotation (usual mechanism of complete tear), if direct with knee flexed then usually isolated (MCL)
- Non-contact: deceleration, cutting or pivoting motion (partial tears)
- Any twisting movement forcing knee in or out with lateral rotation of the tibia (mainly MCL)
- Overuse: In swimmers during breast stroke
- Hyperextension
- May be damaged with other structures.

## Injuries to the MCL

- Sprain
- Avulsion (tender on medial femoral condyle, usually with overuse)
- Complete tear

### Incidence of associated injuries with MCL

- ACL, injured in 20% of grade 1, 78% of grade 3
- Medial meniscus up to 25%
- Vastus medialis oblique up to 21%

## Injuries to and around the LCL

- LCL sprain
- Complete tear is rare and usually involves the posterolateral corner, often managed with reconstruction
- Avulsion or chip fracture of fibular head

### Incidence of associated injuries with LCL (rarely isolated)

- Biceps femoris
- PCL
- Popliteus

## Grades of ligament injury & Principles of Management

(O'Donoghue classification)

### Grade 1 sprain

- Some micro-tearing or slight stretching of fibres
- Ligament is competent (0-5 mm gapping)
- Uncomfortable on stressing but stable end point
- Some tenderness
- May have localised mild swelling (MCL)

**Grade 1:** PRICE, ?NSAID, Active pain-free rehab

### Grade 2 sprain

- Partial tearing of the ligament fibres
- Painful when stressed
- Detectable laxity but end point is preserved (5-10mm gapping)
- Moderate swelling
- Pain on palpation

**Grade 2:** PRICE, ?NSAID, Short term immobilisation (?brace) – time dependant on Extent - active pain-free rehab.

### Grade 3 tear

- Complete ligament tear
- Laxity with no end point (10+ mm gapping)
- Minimal pain on stress due to torn nerves
- Moderate swelling
- Pain on palpation of fibre endings
- Instability

**Grade 3:** PRICE, ??NSAID, immobilise 6/52 (brace).

Regain mobility, strength & proprioception.

Probably out of sport at least 3 months.

The knee can be strapped to support the ligament as activity resumes.





## Dislocation of the patella

Usually caused by:

- Sudden impact
- Indirectly - sudden change of direction with extension on a small, underdeveloped patella or with shallow trochlea.

## Dislocation of the patella

- Usually dislocates laterally, tearing medial retinaculum
- Fragments of cartilage may break off – loose bodies
- Commonly 14 – 18 years
- May be combined with MCL or meniscus

## Symptoms:

- Visible displacement
- Sudden swelling – haemarthrosis
- Ecchymosis – tearing of medial retinaculum
- Tenderness esp. over medial edge of patella
- Reduced mobility

## Treatment:

- RICE
- Allow to settle – cricket splint to protect medial retinaculum
- Mobilise & re-educate muscles esp VMO
- If this fails:
  - Repair medial structures & release of lateral structures.
  - TT transfer
  - Surgery to remove loose bodies

## Inflammatory conditions Patella Tendinopathy

- Treatment based on ‘clinical experience’
- Nothing conclusive in the literature regarding treatment

Patellar tendon pain commonly occurs in sports that produce significant deceleration forces through the tendon. e.g. basketball, squash

Also sports with high traction forces such as hockey on astroturf

## Mechanical loading of the patella tendon

- During walking 0.5kN is stressed across the tendon
- Up to 8kN landing from a jump
- 9kN in fast running
- 14.5kN (17x BW) during weight-lifting
- Basketball players jump around 70x per game (each jump is 6-8x BW)

**This over-strain can cause failure!**

## Symptoms

- Discrete pain at inferior pole of patella:  
after exercise  
increased with squat / kneel (eccentric)  
decrease in continuous pain with rest
- Pain on resisted quads (eccentric > concentric)
- Tender on Palpation

## Treatment

- Rest – decrease load -  
all activities must be  
painfree
- DTFM / SSTM's
- Ice regularly esp after  
activity
- Ultrasound
- Gentle stretching
- **Eccentric exercise**



## Eccentric training (based on work by Jill Cook)

- Warm-up
- On 25 degree slope, bilateral squats to max 90° - pain must not go above 2/3 on 1-10 scale
- As many reps as able without increasing pain above 2/3 – repeat 3X daily
- Gradually increase reps until able to complete 60 x 90° dips, 3 x daily
- Begin regime again but single leg
- Aim for 180 reps daily at 90° (3 sessions)



## Fat pad (Hoffa's) syndrome

### Mechanism

- Impingement between p/f or t/f articular surfaces
- Direct trauma (80%) - fall onto front of knee, dashboard
- Repeated hyperextension of the knee (impingement)
- Overuse during running and jumping sports
- Can be secondary to arthroscopic surgery or other pathology (often patella tendinopathy)

### Symptoms

- Dull infra-patellar ache
- Pain on hyperextension
- Pain on eccentric load at ~ 60 degrees
- Fat pad - visible swelling (40%) enlarged in extension
- Pain on deep palpation
- Hoffa's test positive

## Hoffa's Test/sign

- Supine
- Hip & knee flexed to 90 degrees
- Apply thumb pressure to fat pad
- Extend the knee
- Increased pain in last few degrees of extension



## Treatment

- Protect, – avoid painful activities -  
reduce load
- Try taping superior patella to  
elevate the patella and stop  
impingement
- Gentle thumb massage to mobilise  
tissue & reduce swelling. Encourage  
patient to do at home
- Deeper friction massage as less  
acute to break down scarring/fibrous  
tissue
- Gentle stretching
- Ultrasound
- Maintain / strengthen – VMO  
especially



## Plica Syndrome

Synovial plicae represent inward folds of the synovial membrane

Three such folds are commonly found – usually asymptomatic and of little consequence

Suprapatellar plica (or septum)  
 Medial parapatellar plica (medial shelf)  
 Infrapatellar plica (ligamentum mucosum)

All three can occur together and may blend with one another

## Symptoms

- Dull ache on medial aspect of the knee / supra-patellar area
- Sharp pain/catching on certain movements
- Recurrent effusion
- Stiffness / pseudo-locking (movie goes knee)
- Giving way
- It is often palpable & tender over the medial femoral condyle with the knee in flexion

## Treatment

(early acute stage)

- DFM to localised tender area
- Ultrasound
- ? NSAIDS
- Progressive quads stretching as acute phase passes
- Avoidance of aggravating activities is essential initially

### Suprapatellar plica

### Impinging Medial Plica



## Other Common Inflammatory Conditions

- Popliteus tendinitis is seen in hill runners results from excessive tibial rotation.
- Biceps femoris tendinitis usually in excessive acceleration or deceleration
- Gastrocnemius tendinitis, overuse in hill running and long distance. Inflammation of medial head at attachment to femoral condyle
- Pes anserinus (tendinitis and bursitis). Insertions of sartorius, gracilis and semitendinosus into tibia. Overuse in swimmers (breast stroke), cycling, rowing and running

## JOINT SURFACE DAMAGE

Localised / Generalised  
 Acute / Chronic

### HYALINE CARTILAGE:

5% cells, 20% collagen & proteoglycans, 75% water !!!

Nearly frictionless movement  
**Unable to re-grow when injured**

### Grades of articular surface changes

- I Surface softening fibrillation
- II Chondral flaps, small fissures
- III Cracks, loose flaps but no bare bone
- IV Full thickness degeneration, bony eburnation

## Symptoms

### Acute

- Effusion
- Pain on weight bearing
- Catching / locking
- Toothache type pain ↑ with activity
- Tenderness over damaged area

### Chronic

- Capsular thickening
- Effusion
- Aching ? Worse with activity
- Night pain
- Positional stiffness
- Capsular pattern (slight flexion)

## Trauma      Inflammation      Degeneration (OA)



## Non-Operative Treatment

- Range of Movement – flex & extension
- Strength
- Reduce inflammation – NSAIDS, Injection
- ? Glucosamine, Chondroitin etc

**Likely other pathology**

**Do not ignore constant effusion**

## Osteochondritis Dissecans

- Focal separation of bony fragment from WB surface of femoral condyle
- Aetiology is speculative
- Most common in ages 10-20, but up to 60 possible
- Males:females = 3:1
- Bilateral in 30 – 40% (younger patients more likely to be bilateral)
- 75% are medial; 25% lateral

## Treatment for OCD

- Prognosis for spontaneous healing is ↑ prior to physal closure:
- Treat with NWB and immobilisation for up to 6 months.
- Prognosis ↓ with age – more likely to need surgery:
  - Drilling
  - Pinning
  - Grafting



## Ischemic Necrosis

Symptoms:

- Any age especially if associated condition present – sickle cell disease; post irradiation necrosis.
- Vague aching in the knee which may or may not be affected by weight bearing.
- Night pain.
- Examination may show minimal effusion, full ROM and no evidence of instability.

MRI is the best diagnostic tool as it shows abnormal interosseous tissue.

## Patellar maltracking

- Subluxation (glide)
- Tilt (ELPS)
- Subluxation & tilt
- Traumatic: - subluxation  
- dislocation



### **Risk Factors (massive):**

These can be divided into three categories –

- Leg alignment
- Bony
- Ligamentous



## Assessment

### History:

- Onset – acute or gradual
- Pain – general ache or sharp pain
- Site – vague or specific
- Giving way/instability; locking/sticking; clicking;
- Aggravating activities – ? pain during or after.
- Stairs; kneeling; squatting
- Sport – type of activities; surface; repetitive nature; note any recent changes to training, footwear etc.

## Leg Alignment

These factors may produce maltracking despite normal bony contours, soft tissue restraints & neuromuscular function

- Femoral neck anteversion → internal rotation of the femoral sulcus & resultant ↑ Q'angle
- External tibial torsion → ↑ Q'angle
- Subtalar pronation → ↑ Q'angle
- Genu recurvatum → lifts the patella off the femoral surface thus ↑ instability
- Patella alta → in effect a superior patellar subluxation



## Bony Factors

- Prominence of the LFC
- Sulcus angle
- Configuration of the patella

## Ligamentous factors

- Medial & lateral retinacula and their ligaments
- Tightness of the lateral structures
- Laxity in the medial structures

## Risk Factors (dynamic):

- Imbalance in the strength ratios of the various components of the quadriceps muscle (VMO? or VL?)
- Disruption to normal motor control of the quads (firing times)
- Tight hamstrings or gastrocs → restriction of full knee extension → increased PF joint reaction force
- Tight ITB → increased pull on the lateral retinaculum

## The Role of VMO:

- It is the only dynamic medial stabiliser
- It is active throughout FULL range (not merely the last 30° of extension)
- It has a separate nerve supply from a branch of the femoral nerve – it can be activated separately
- It is inhibited by only 20ml of fluid in the joint – VL & RF require 60ml (Spencer & Hayes, 1984)

## Treatment: address muscle weakness/imbalance & tight structures

Consider range of movement & type of exercise

### NB

- During open chain exercise the patello-femoral joint stress ↑ as the joint moves from 90° to 0°. (this means that IRQ's exercises over a pillow produce large forces & also cause shearing of joint surfaces)
- During closed chain exercises the patello-femoral joint stress ↑ as the knee moves from 0° to 90°. (deep knee bends, going down stairs and squatting all ↑ force through joint)

### Note

Perhaps we should do inner range work with closed chain exercises, and middle range work with open chain exercises

(Steinkamp et al. 1993)

Stretch tight lateral structures



Gluteus med strengthening



Inner range CKC – leg alignment



## Check leg alignment during exercise



## Remember

Quads exercises should be painfree – pain causes muscle inhibition

If there is a painful arc – work either side of it with variable angle isometrics if necessary

Progress exercises as able & include proprioception, agility, speed & endurance

Flexibility: Quads, hamstrings & calf stretches

“The health practitioner may be able to enhance, delay or damage the healing process” (Houglam, 1992)

## HOWEVER

Our aim has to be to return the patient to pre-injury level of activity

