Paediatric ACL injuries

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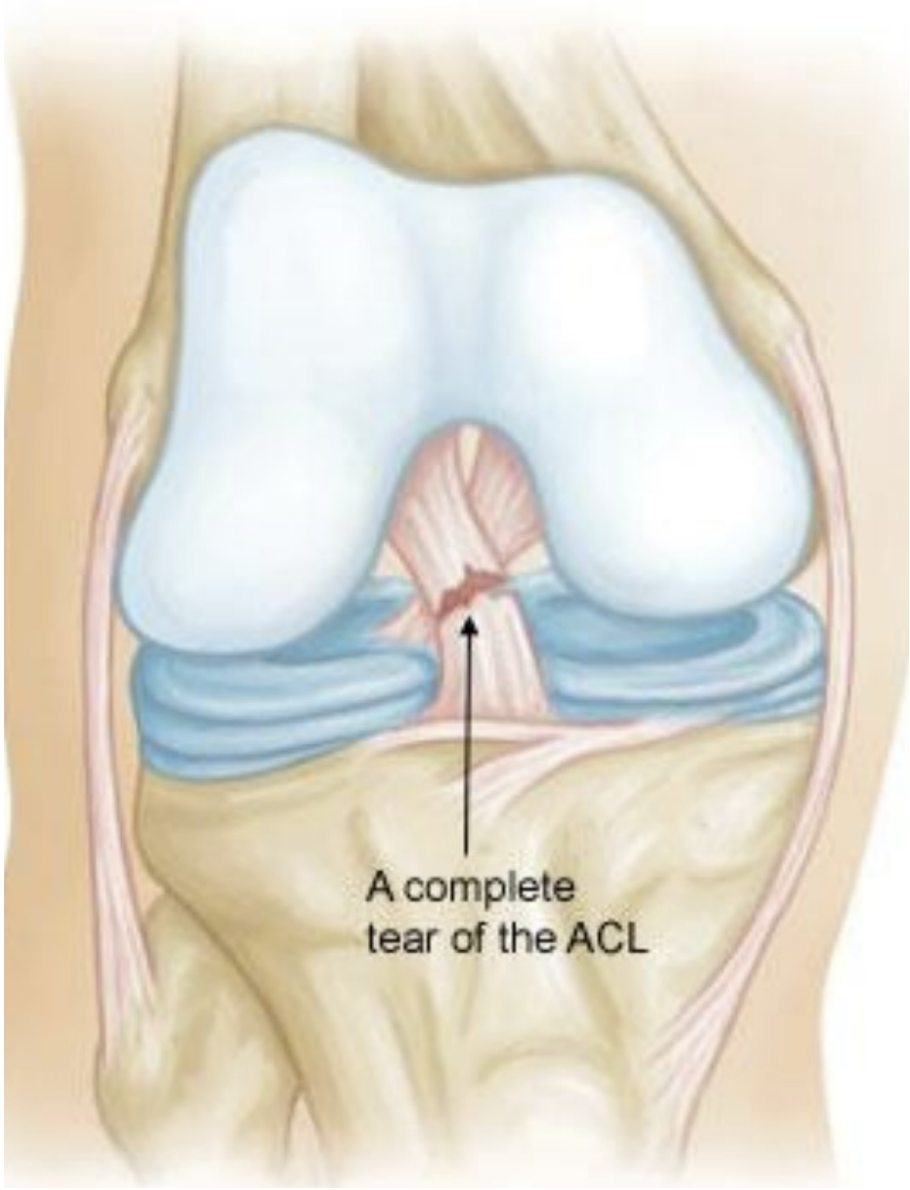
ACL injuries

- Increasing incidence with competitive sport
- F:M 4:1
- Surgical management depends on remaining growth



ACL Injuries – History and Examination

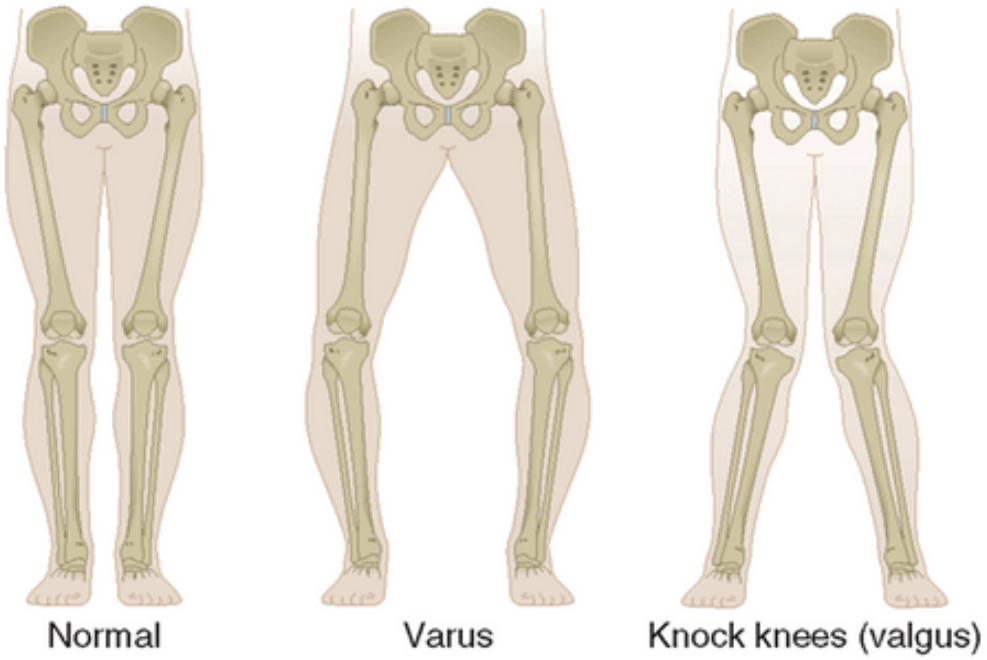
No isolated question, clinical test or imaging modality can accurately diagnose an ACL injury every time

Key history points

- Mechanism of injury
  - Non-contact pivot or hyperextension injury
- Early haemarthrosis
- Ability to weight bear post
- Previous knee injuries
- Locking/catching/clicking
  - Meniscal pathology/OCD
- Age, menarche, growth velocity

Knee Examination

- Alignment
  - Valgus knee alignment predisposes to ACL tear
- Gait
  - Need for brace/walking aids
- Effusion/Haemarthrosis
- Palpation
- Range of motion
- Clicking/Catching/ Locking



Knee Examination – Special Tests

- Always compare to contralateral side
- Children have more joint laxity than adults, difference between sides is more important than absolute figures

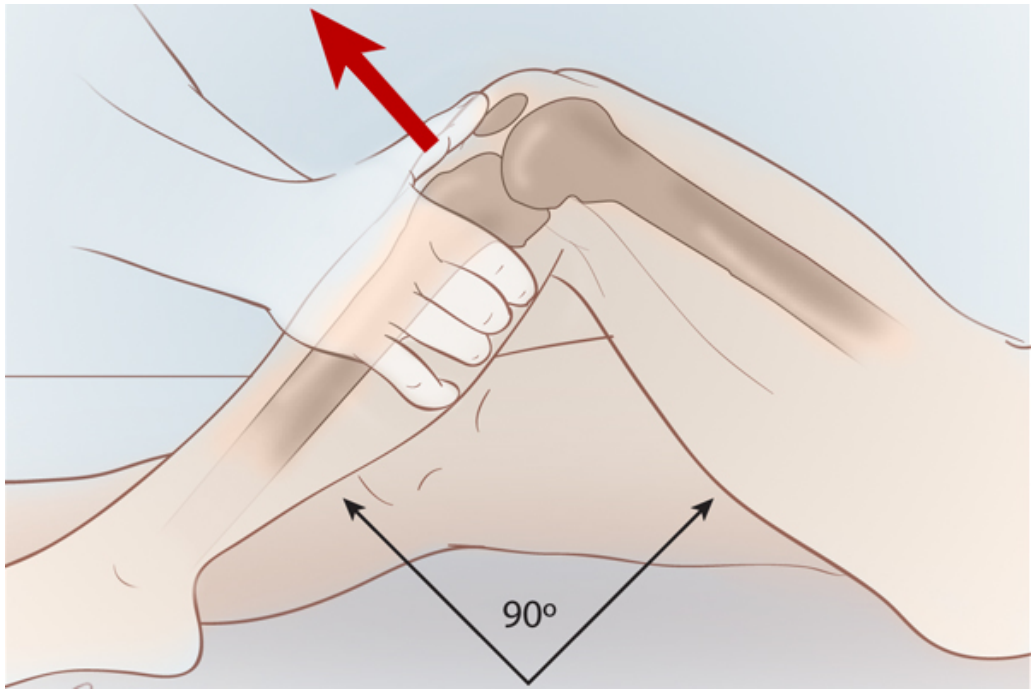
Knee Examination – Special Tests

Anterior drawer

- Hip flexed to 45*
- Knee flexed to 90*

- Positive if >5mm difference to contralateral side

- 22.2% sensitivity and 95% specificity within 2 weeks
- 40.9% sensitivity and 98.4% specificity after 2 week

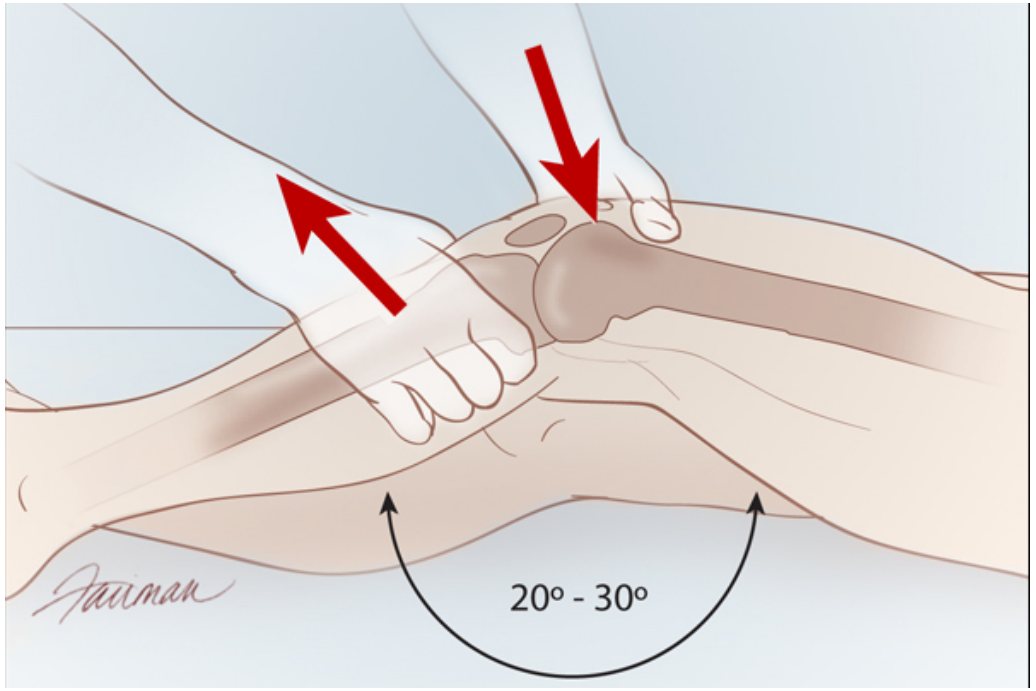


Knee Examination – Special Tests

Lachman's Test

- Knee bent 20-30*
- Positive if >2mm difference to contralateral side

- 77.7% sensitivity and >95% specificity with 2 weeks
- 84.6% sensitivity and >95% specificity after 2 weeks

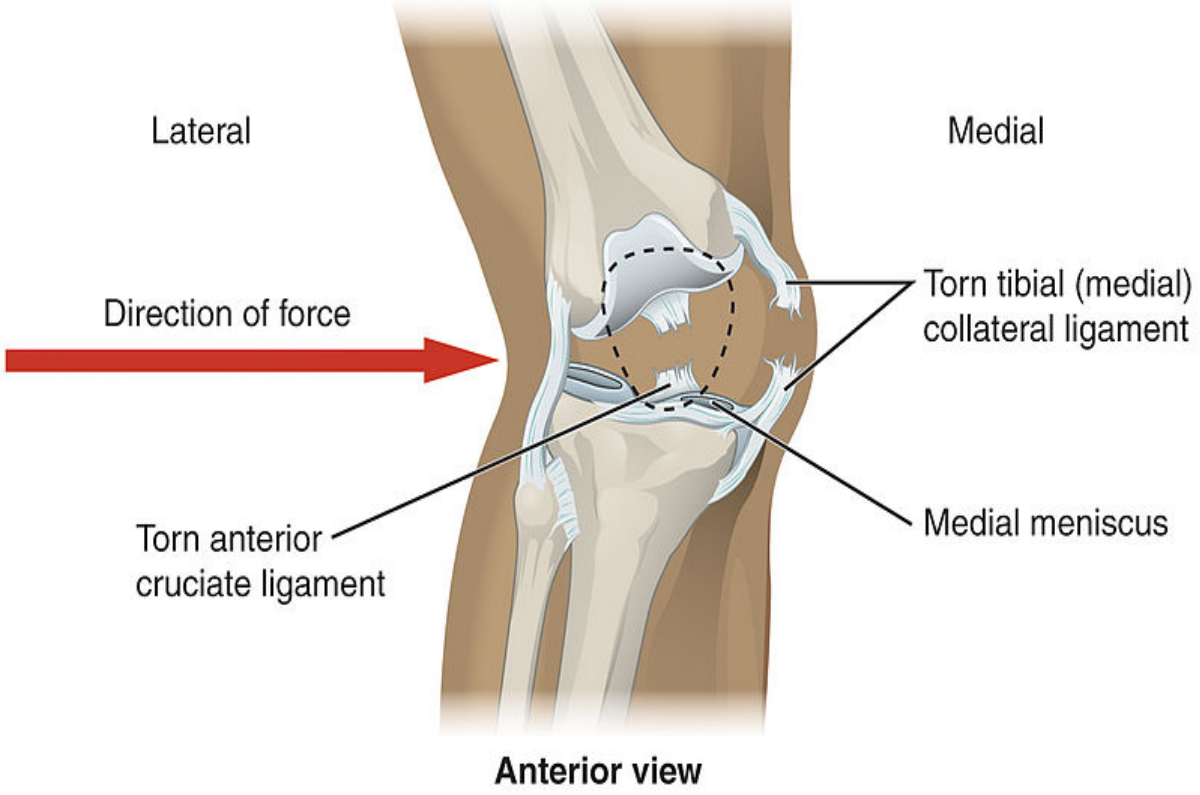


Knee Examination – Special Tests

Valgus Stress Test (MCL)

- Knee flexed to 30*
  - Isolates MCL
- Knee full extension
  - MCL, capsule, ACL, PCL

- 86%-95% sensitive

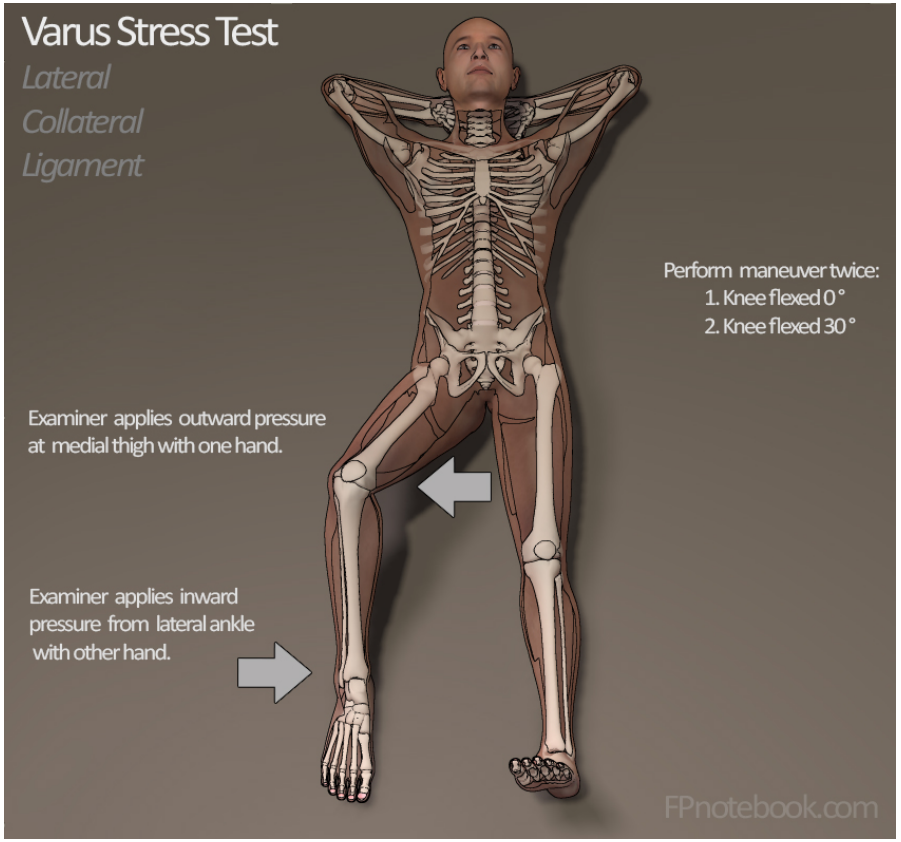


Knee Examination – Special Tests

- **Varus Stress Test (LCL)**

- Knee flexed to 30*
- Knee full extension
  - ITB, Biceps Femoris, Arcuate complex, PLC

- Sensitivity 25%



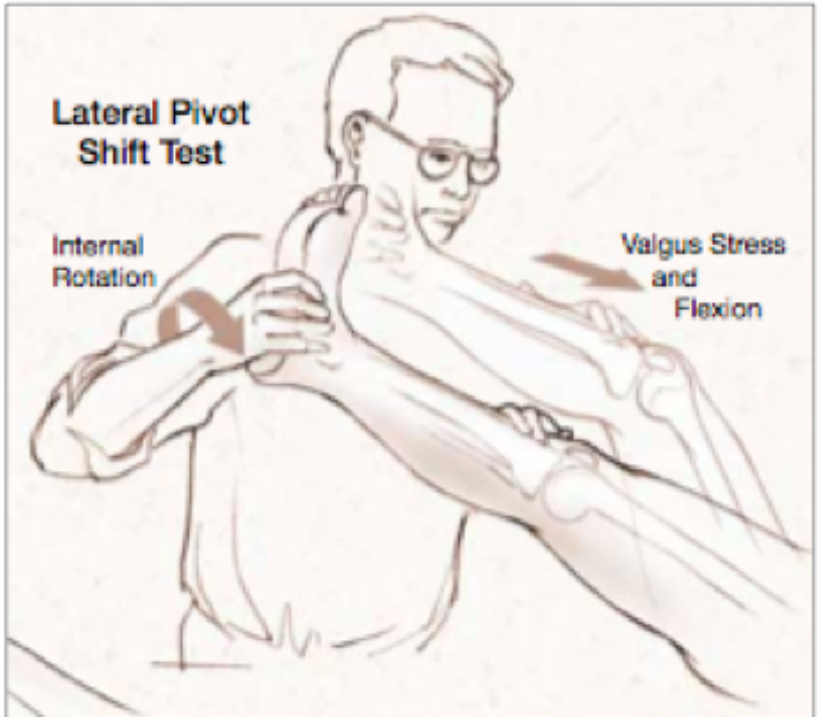
Knee Examination – Special Tests

Pivot Shift Test

- Knee in full extension
- Foot in internal rotation
- Axial load, valgus force

- Slowly bend knee, as ITB passes over femoral condyle it will reduce the subluxed tibia

- 36% sensitivity and 99% specificity with 2 weeks



ACL Injuries - Investigation

- Plain XRs – Always required
- MRI – Useful*
- CT – Bony injuries

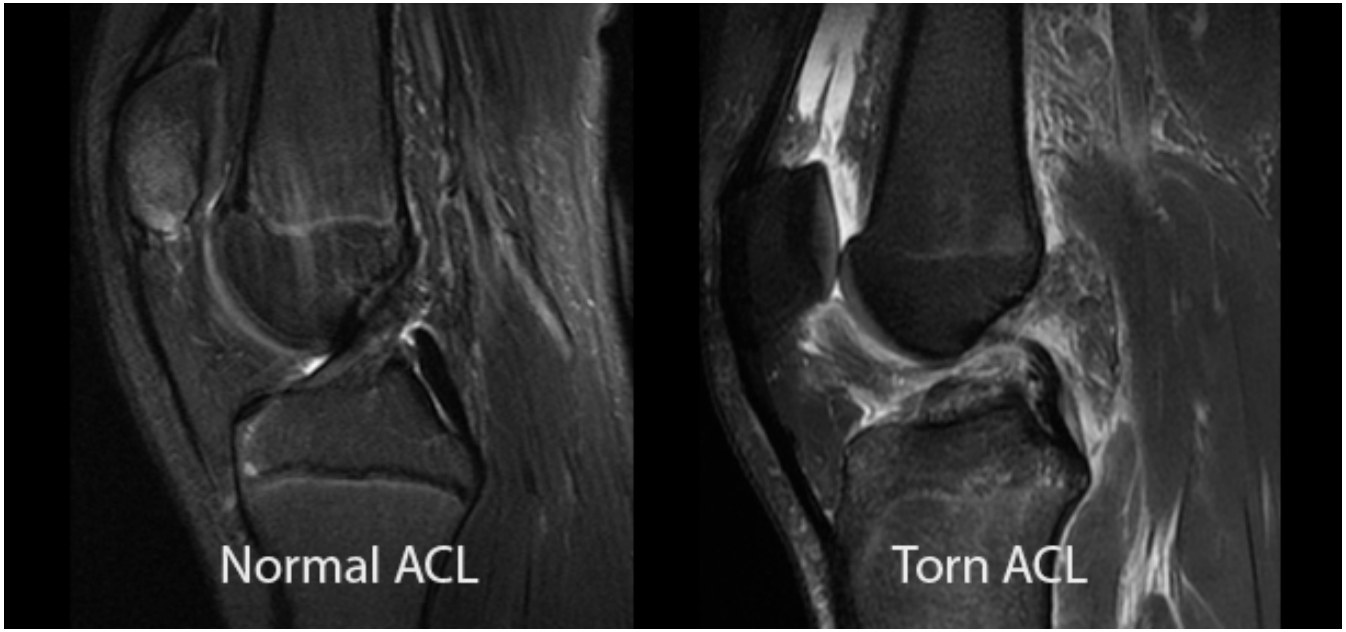
- EOS - All operative cases

Tibial Spine Avulsion

- Variant of ACL injuries
- Diagnosed on XR/CT
- Operative treatment for displaced injuries
- Non-operative Rx – cylinder cast

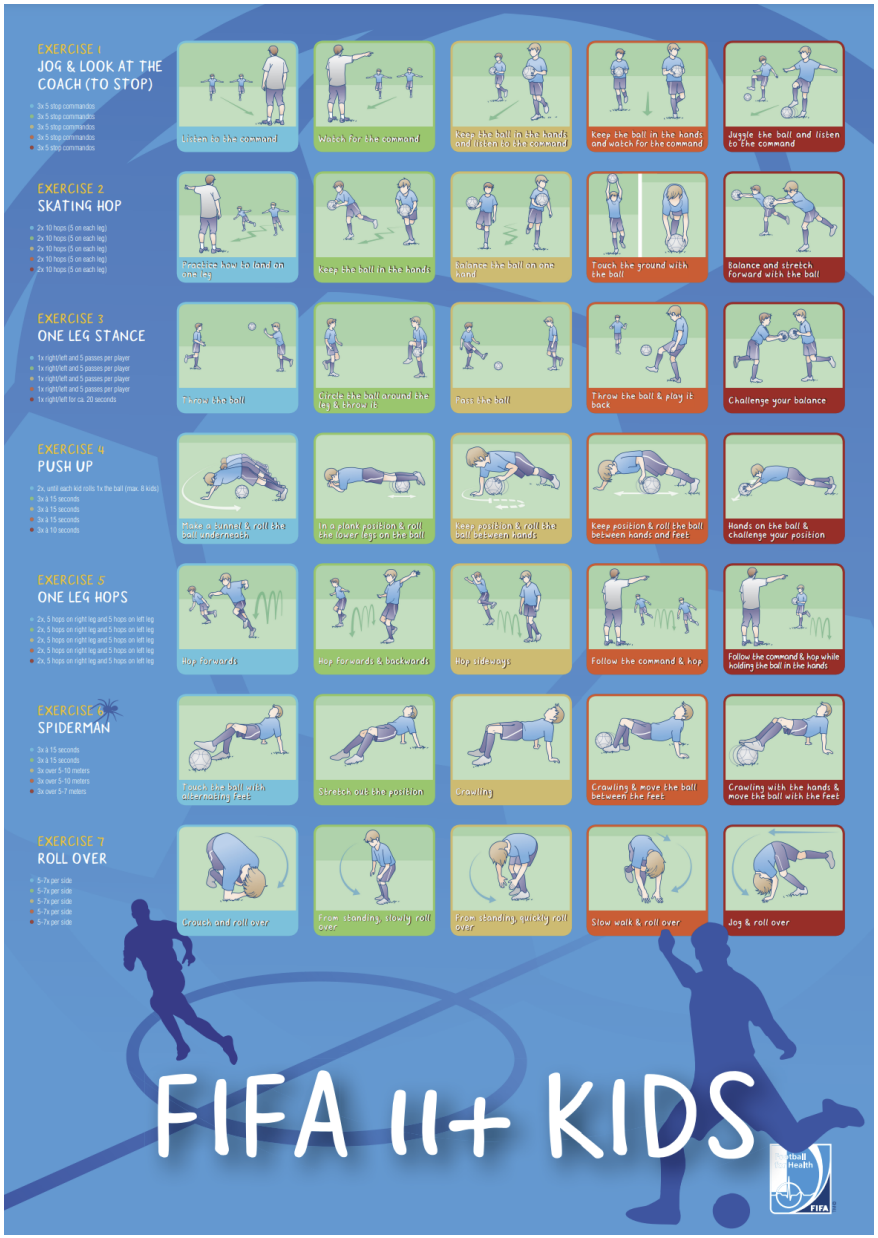
ACL Injuries - MRI

- Always order – locked knee
- Consider – clinical suspicion of ACL or meniscal injury
- Not required – Tibial eminence avulsion, most bony injuries



ACL Injuries - Management

- Preventative – FIFA 11+ for kids
- Non-operative – focused physiotherapy
  - *Dynamic, multijoint neuromuscular control*
- Operative – age dependent



ACL Injuries – Indications for surgery

1. The child has repairable associated injuries that require surgery (eg, bucket-handle meniscus tear, repairable meniscal lesion or osteochondral defect).
2. The child has recurrent, symptomatic knee giving way after completing high-quality rehabilitation.
3. The child experiences unacceptable participation restrictions (ie, an unacceptable modification of activity level to avoid knee giving way).

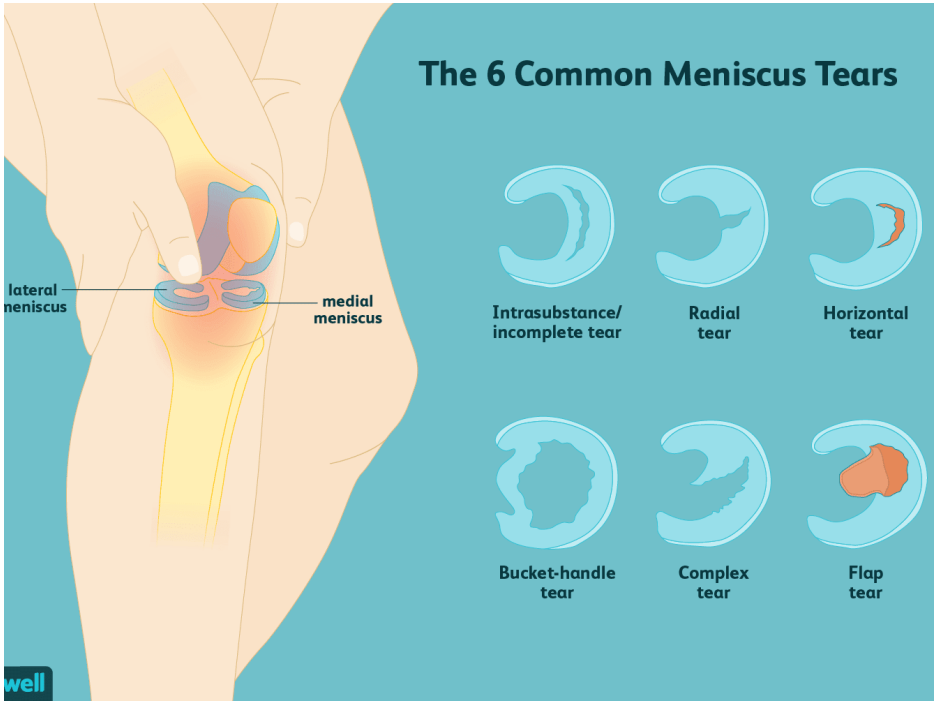
IOC consensus statement 2018 Paediatric ACL injuries

ACL Injuries – Natural History

- ACL injuries have low rates of return to competitive sport
- No long term studies on OA (Adults symptomatic OA in 10 years)
- High rates of subsequent meniscal injuries (2%/month)

ACL Injuries – Associated injuries

- Meniscal tear 58%
  - Increase by 12% for every 2 BMI points over 25
  - Increase by 16% for every year of age over 10



Rates of Concomitant Meniscal Tears in Pediatric Patients With Anterior Cruciate Ligament Injuries Increase With Age and Body Mass Index

Crystal A. Perkins,*† MD, Melissa A. Christino,‡ MD, Michael T. Busch,† MD, Anthony Egger,† MD, Asahi Murata,† BS, Michael Kelleman,§ MSPH, and S. Clifton Willimon,† MD

Investigation performed at Children's Healthcare of Atlanta, Atlanta, Georgia, USA

ACL Injuries - Diagnosis

Table 1 Diagnostic accuracy of clinical examination and MRI in intra-articular knee disorders (adapted from Kocher *et al*[27])

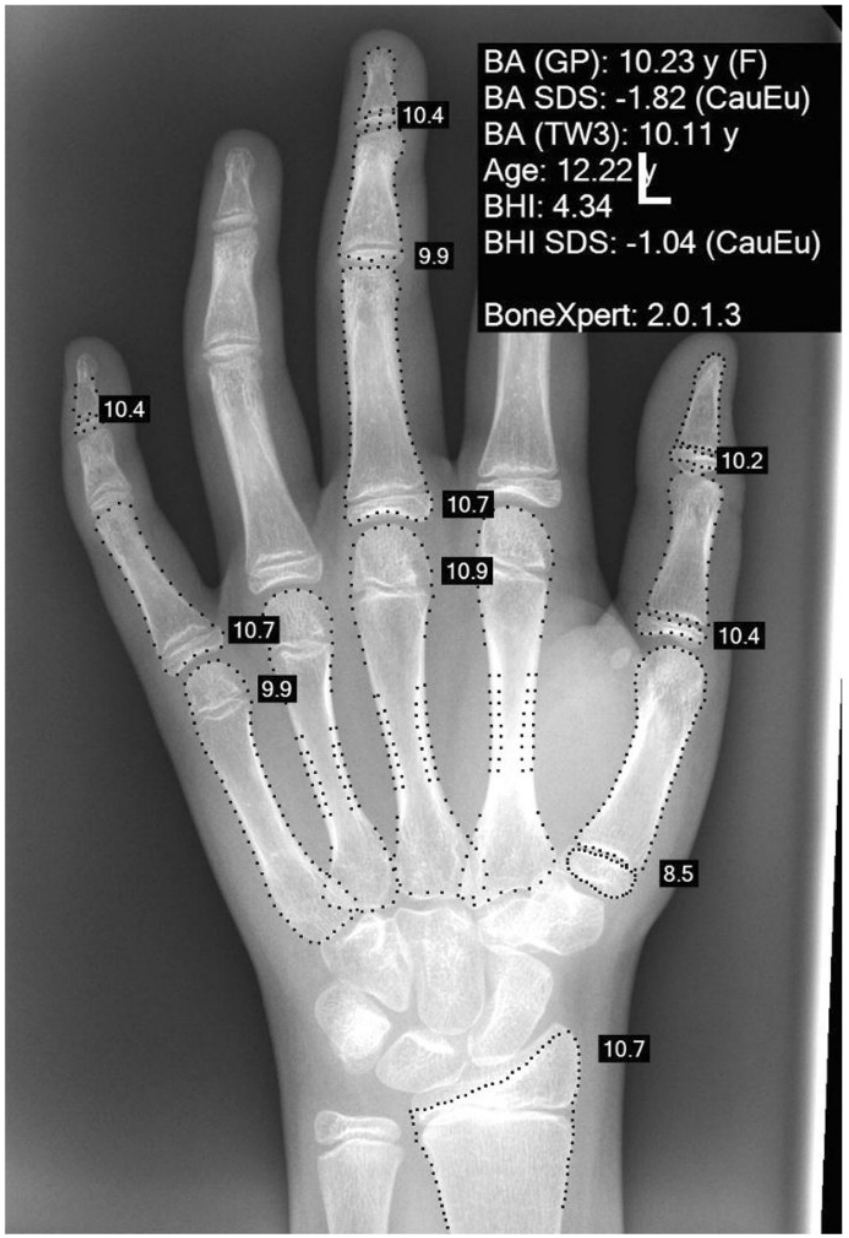
	Sensitivity (%)			Specificity (%)			Positive predictive value (%)		Negative predictive value (%)	
Diagnosis	Clinical examination	MRI	P value	Clinical examination	MRI	P value	Clinical examination	MRI	Clinical examination	MRI
ACL tear	81.3	75.0	0.55	90.6	94.1	0.39	49.0	58.6	97.8	97.1
Medial meniscus tear	62.1	79.3	0.15	80.7	92.0	0.03	14.5	34.3	97.6	98.8
Lateral meniscus tear	50.0	66.7	0.24	89.2	82.8	0.21	34.0	30.1	94.1	95.7

Clinical examination was patient history, physical examination and X-rays performed by a paediatric orthopaedic sports medicine specialist or a postresidency paediatric sports medicine follow

1.Kocher MS , DiCanzio J , Zurakowski D , *et al*
. Diagnostic performance of clinical examination and selective magnetic resonance imaging in the evaluation of intraarticular knee disorders in children and adolescents. Am J Sports Med 2001;**29**:292–6.doi:10.1177/03635465010290030601

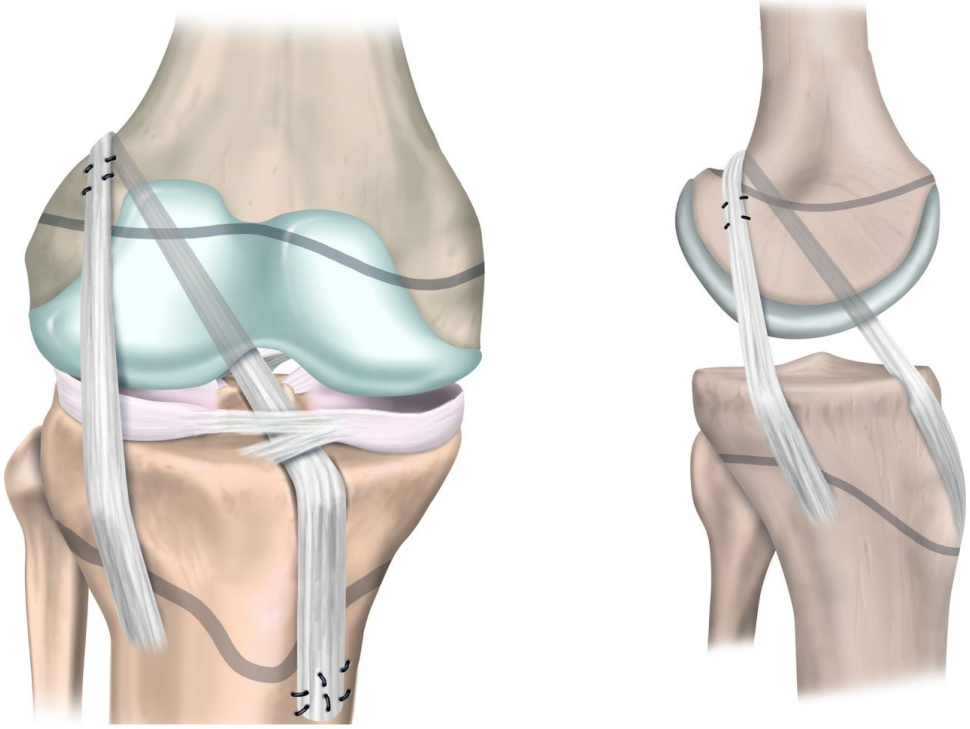
Surgical Management

- Based on skeletal age and associated injuries



ACL Injuries – Over the top reconstruction

- Young children
- Non-anatomic
- Strip of ITB re-routed through the knee and fixed to proximal tibia

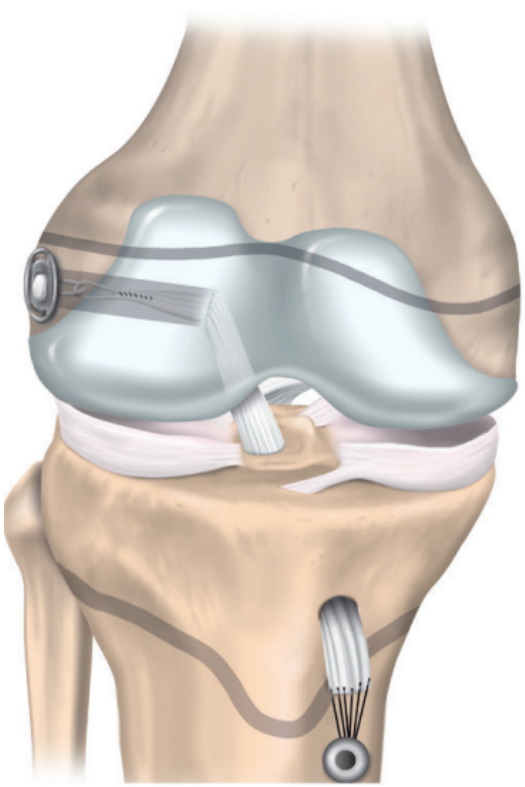


A. Anterior view

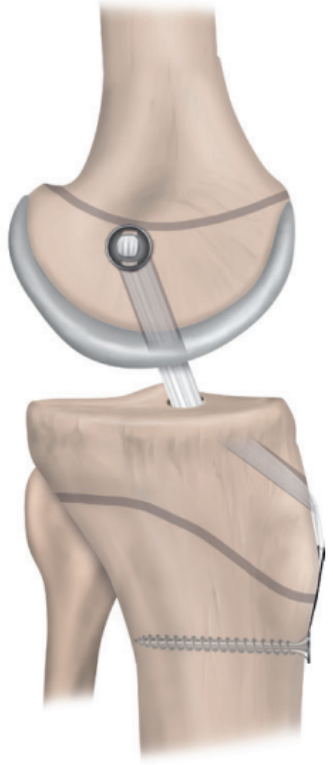
B. Lateral view

ACL Injuries – Physeal Sparing

- Boys 10-14, Girls 10-12
- Drill holes avoiding physis
- Higher re-rupture rate than anatomical ACL reconstruction



A. Anterior view

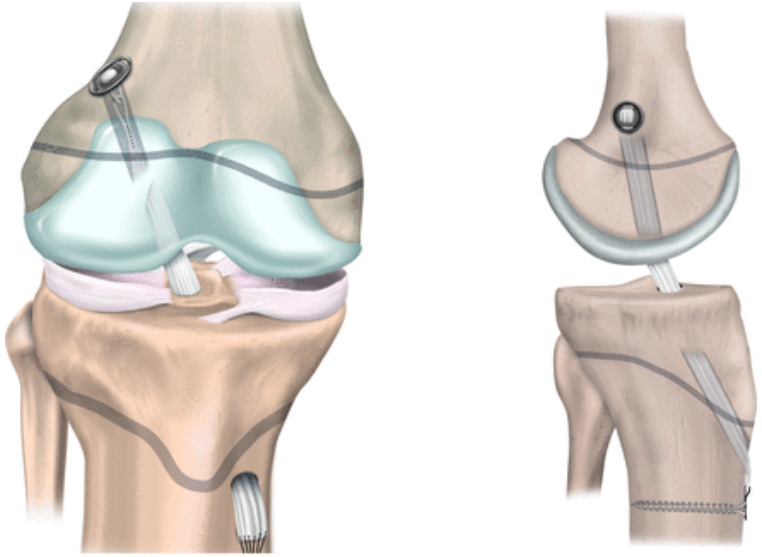


B. Lateral view

ACL Injuries – Transphyseal Reconstruction

- Within 2 years of skeletal maturity

- Similar to adult ACL recon
- Steeper tunnels
- Suspensory fixation
- Hamstrings graft

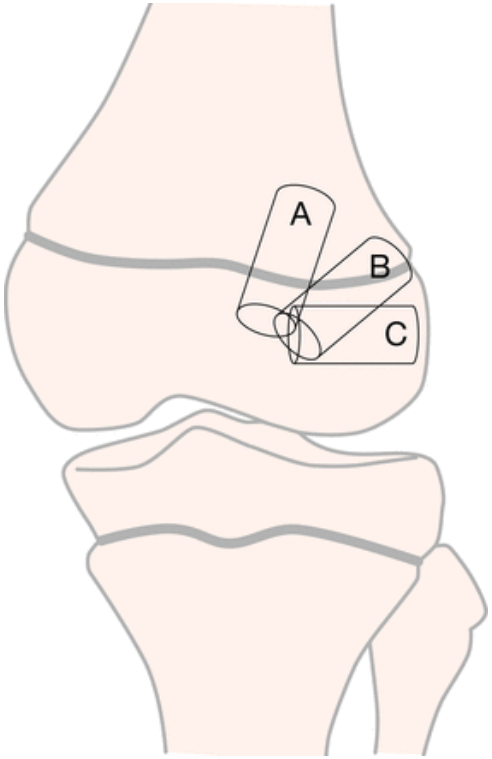


A. Anterior view

B. Lateral view

ACL Injuries – Technique points

- Minimise growth disturbance
- Avoid the perichondral ring
- Central, steep tunnels



ACL Injuries – Surgical risks

- Growth disturbance
- Re-injury (ipsilateral 13%, contralateral 14%)
- Stiffness
- Infection

Post-op

- Swelling control, ice packs
- ROM focussing on full extension as 1st goal
- Gentle cycling from 6 weeks
  - Risk of graft stretching before 12 weeks
- Jogging from 4 months
- Return to sport minimum 12 months
- Triple hop >90% contralateral
- Muscle strength >90% contralateral

Take home points

- Always get an XR
- Clinical examination is important, but less reliable than adults
- MRI better to exclude pathology rather than diagnose
- Surgical management based on remaining growth

Thank you

ACL rehab & return to sport protocol

Recommended functional tests and return to sport criteria for the child and adolescent with ACL injury

- ***For patients who choose ACL reconstruction***
- Prehabilitation
- Full active extension and at least 120 degrees active knee flexion
- Little to no effusion
- Ability to hold terminal knee extension during single leg standing
- **For adolescents**: 90% limb symmetry on muscle strength tests

For patients who choose ACL reconstruction OR non-surgical treatment

- **Phase I to phase II**
- Full active knee extension and 120 degrees active knee flexion
- Little to no effusion
- Ability to hold terminal knee extension during single leg standing
- **Phase II to phase III**
- Full knee range of motion
- 80% limb symmetry on single-leg hop tests, with adequate landing strategies
- Ability to jog for 10 min with good form and no subsequent effusion
- **For adolescents**: 80% limb symmetry on muscle strength tests
- Phase III to phase IV: sport participation (return to sport criteria), and continued injury prevention
- Single-leg hop tests: >90% of the contralateral limb (with adequate strategy and movement quality)
- Performed gradual increase in sport-specific training without pain and effusion
- Confident in knee function
- Knowledge of high injury-risk knee positioning, and ability to maintain low-risk knee positioning in advanced sport-specific actions
- Mentally ready to return to sport
- **For adolescents**: 90% limb symmetry on muscle strength tests
- Muscle strength testing should be performed using isokinetic dynamometry or handheld dynamometry/one repetition maximum. The type of test and experience of the tester are highly likely to influence the results. If using handheld dynamometry/one repetition maximum, consider increasing the limb symmetry criterion cut-off by 10% (ie, 90% limb symmetry becomes 100% limb symmetry). Clinicians who do not have access to appropriate strength assessment equipment should consider referring the patient elsewhere for strength evaluation.